PROPERTY OF DENTAL LIBRARY UNIVERSITY OF MICHIGAN DON'T MUTILATE OR REMOVE
Cop. 4
AUG 13 1934

AUGUST, 1934 No. 8

International Journal of Orthodontia and Dentistry for Children

Editor, H. C. POLLOCK

ASSOCIATE EDITORS IN ORTHODONTIA

OREN A. OLIVER JAMES D. McCOY FRANK M. CASTO JOSEPH D. EBY
PAUL G. SPENCER

DEPARTMENT OF ORTHODONTIC ABSTRACTS
Associate Editor—EGON NEUSTADT

DEPARTMENT OF DENTISTRY FOR CHILDREN
Associate Editor—WALTER T. McFALL
Contributing Editors—FLOYDE E. HOGEBOOM, THADDEUS P. HYATT,
WALTER C. McBRIDE

Published by The C. V. Mosby Company, 3523-25 Pine Blvd., St. Louis, U. S. A.

Entered at the Post Office at St. Louis, Mo., as Second Class Matter
COPYRIGHT BY THE C. V. MOSBY COMPANY, ST. LOUIS

DEE-GOLDS
Precious Metals MADE MORE PRECIOUS BY Scientific Treatment

SOMETHING NEW!!
TALON-GRIP FINISH
BAND MATERIAL
a DEEpendable product

International Journal of Orthodontia and Dentistry for Children

CONTENTS FOR AUGUST, 1934

Original Articles

The Classification, Etiology, Diagnosis, Prognosis, and Treatment of Radicular Resorption of Teeth. John Albert Marshall, D.D.S., Ph.D., San Francisco, Calif. ---- 731

Cleft Palate and Harelip: An Adolescent Case Treated Orthodontically in Conjunction With a Lip-Stretching Device and Skin Grafting of the Labial Sulcus. E. A. Hardy, L.D.S., M.R.C.S., L.R.C.P., London, England ---- 750

The Crisis in Orthodontia. Albin Oppenheim, Vienna, Austria ---- 759

The Possibilities of, and Difficulties Associated With, Fixed Appliance Work. H. C. Visick, L.D.S., Eastbourne, England ---- 770

The Possibilities of, and Difficulties Associated With, Fixed Appliance Work. Norman Gray, L.D.S., H.D.D., Eastbourne, England ---- 776

Committee Reports Presented Before the American Society of Orthodontists at the Thirty-Second Annual Meeting ---- 784

Department of Dentistry for Children

Universal Dental Care for Children. Harry Strusser, D.D.S., New York, N. Y. 799

Unerupted Molar and Premolar Type of Functional Space Retainer. Floyde Eddy Hogeboom, D.D.S., Los Angeles, Calif. ---- 808

The Form and Dimensions of the Palate in the Newborn. M. F. Ashley-Montagu, Ph.D., New York, N. Y. ---- 810

If Deciduous Teeth Could Talk. Harry B. Shafer, D.D.S., Anna, Ill. ---- 828

Outline of Pedodontia Course as Taught at Marquette University. George E. Morgan, D.D.S., F.A.C.D., Milwaukee, Wis. ---- 829

Department of Orthodontic Abstracts and Reviews

A Textbook of Dentistry ---- 833

Editorial

More Service and More Work ---- 839

International Journal of
Orthodontia and Dentistry
for Children

(All rights reserved)

VOL. 20 ST. LOUIS, AUGUST, 1934 No. 8

ORIGINAL ARTICLES

THE CLASSIFICATION, ETIOLOGY, DIAGNOSIS, PROGNOSIS AND TREATMENT OF RADICULAR RESORPTION OF TEETH*

JOHN ALBERT MARSHALL, D.D.S., PH.D., SAN FRANCISCO, CALIF.

INTRODUCTION

THERE is no truer example of preventive dentistry than the prevention of certain types of pathologic radicular resorption. Whether the injury is bacterial, chemical, or developmental, there are means available in some cases which will reduce the incidence of this lesion as well as its severity. But the treatment, when dietary in nature, begins before the orthodontist is consulted. It begins before the birth of the patient. It goes back to the second or third month of pregnancy when supervision is exercised over the diet by the obstetrician. Unfortunately the full benefit of the present-day knowledge of nutrition cannot now be utilized, for some of the patients of today were born from undernourished parents. When the problem of undernourishment ceases to be a major one, the orthodontist will have fewer examples in his practice of pathologic radicular resorption. But until that time arrives—if it ever does—resorptions are bound to occur. They will be less frequent, also, when the physician cooperates fully with the dentist. Part of this cooperation consists in instructing both patient and parent in careful dietary programs. From the standpoint of the successful practitioner, whether it be the specialist in orthodontics or in crown and bridge prosthesis, it is just as necessary to make a careful prognosis as it is to diagnose and treat the case correctly. It is becoming increasingly apparent that the prognosis of many kinds of anomalies may rest in part upon the shoulders of the pediatrician. It would become his duty to determine and to

*Read at the Thirty-Second Annual Meeting of the American Society of Orthodontists, Oklahoma City, Oklahoma, November 8, 9, and 10, 1933.

Aided by grants from the American Society of Orthodontists and the Board of Research of the University of California.

From the Laboratories of the Hooper Foundation for Medical Research and the College of Dentistry, University of California.

maintain the state of health of many of these patients. Neither dentist nor orthodontist is qualified properly to assume this responsibility; for example, the matter of growth rate in accordance with age, height, weight, and sex is most important. There must be considered also the problem of immunity from or susceptibility to infection. Of equal significance is the study of metabolic disease involving not only the various anemias but also those conditions which develop from dysfunction of the thyroid gland or other members of the important group of glands of internal secretion. All of these various parts of the picture must be visualized and seen in their proper perspective. Another point that cannot be overlooked in this important relationship between patient, physician and dentist is the hereditary background of the patient. Perhaps the phrase "constitutional pathology," as suggested by Karl Meyer, expresses the thought. By "hereditary" is meant not merely the presence of certain dental anomalies of formation or of growth. The term is used in its widest interpretation, and includes the tendency, or lack of it, toward the development of tuberculosis, or of anemia, or other infectious or metabolic disease. Not the least of these various points which are to be considered is the tendency toward obesity in the adolescent patient. The family tree, "at least its nearest branches," should be scrutinized carefully and records kept dealing with the diseases not only of the patient but also of the parents and, if possible, of the grandparents.

It is more apparent than ever that borderline diets may predispose a patient to disease—either metabolic or infectious. Such patients are frankly poor risks; they do not always respond satisfactorily to treatment. The hard tissues are hard only in name. The teeth can be moved easily enough—but are not maintained in their new position—they drift back. Later they are moved again only to return a second, third, and fourth time to the old malpositions. Resorptions of an extensive nature may be expected to develop under these unfavorable circumstances. But with the well-nourished patient the chances are favorable for a satisfactory response to orthodontic treatment. This response includes normal development of bone; so that teeth, when realigned, will not tend to drift back to the former malposition.

ETIOLOGY AND CLASSIFICATION

Radicular resorptions are classified first in accordance with the presence or absence of infection. The description of physiologic root resorption of deciduous teeth has been dealt with extensively by many writers: Noyes,[1] Black,[2] Hopewell-Smith,[3] Orban,[4] Kronfeld,[5] and Marshall[6] have discussed this problem from various viewpoints. It has been clearly demonstrated, both clinically and experimentally, that deciduous teeth having uninfected pulps show normal root resorption developing in accordance with the rate of skeletal growth of the individual. That is to say, coincident with the coronal calcification of the permanent tooth the deciduous roots are resorbed by the various tissue cells in the periodontal membrane and the pulp. (Figs. 1, 2 and 3.)

Both deciduous and permanent teeth may develop resorptive processes on the roots as a result of an untreated chronic apical abscess. The pathogenesis of the lesion is as follows[7]: Dental caries is the usual cause of pulp infection, and

Fig. 1. Fig. 2.

Fig. 1.—Early stage of resorption on deciduous mandibular lateral incisor. Note the eroded area at the apical portion. *A*, Normal cementum; *B*, beginning of resorption.

Fig. 2.—A later stage in apical resorption. Both the dentin and the cementum in the apical portion are being resorbed. *B*, Area of active resorption at enlarged apical foramen.

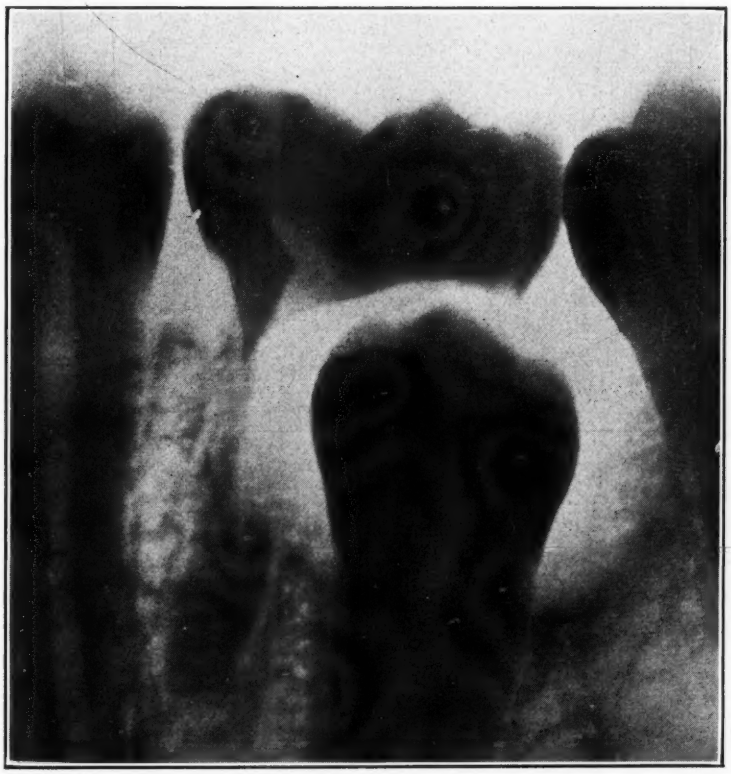


Fig. 3.—An enlargement of a roentgenograph showing the radicular and coronal resorption on a mandibular deciduous first molar. The unerupted premolar is almost formed.

its bacteriology has been well worked out. Two organisms, the *Leptothrix buccalis* and the *Cladothrix placoides* adhere to the surface of the enamel, and enmesh gradually a sufficient amount and kind of débris to favor the growth of several types of acid forming organisms. After these have produced sufficient decalcification of the tooth to form a cavity, a new symbiotic relationship develops in which *B. putrificus* effects a proteolysis of the organic matrix. Thus both the inorganic and the organic material is washed away by the fluids in the mouth, and the cavities gradually increase in size. Incidental with this, a third symbiosis occurs. This time *B. putrificus* and various types of streptococci and

Fig. 4.—An enlargement of a roentgenograph. A chronic apical abscess untreated for several years has produced pathologic resorption on the apices of the second premolar and first molar. The partly filled canals are factors in the etiolcgy.

staphylococci propagate in the cavity, and eventually produce infection of the pulp. The infection thus proceeds through the pulp of the tooth into the canals, and so on to the peridental membrane and alveolar process. There is no essential difference in the lesions found in deciduous and permanent teeth. The organisms are practically identical but may break down the tooth structure more rapidly in the deciduous teeth. It is not within the scope of this paper to discuss the treatment of caries from the standpoint of metabolic studies, but such a type of therapy in conjunction with proper operative procedures accomplishes gratifying results. If the treatment is begun early enough, caries is less liable to occur.

When pulp infection reaches the peridental membrane and involves the apices of teeth, a new lesion develops which, unless treated, produces rarefying osteitis. (Fig. 4.) This type of root resorption is found, usually, on teeth on which no appliances have ever been placed. Furthermore these resorptions are characterized, as has been pointed out many times, by certain processes not found in noninfected cases. But when the pulps of deciduous teeth become infected and necrotic, complications arise which delay the rate of normal exfoliation of these teeth and usually the eruption of the permanent teeth. Frequently this retardation is such that the unerupted tooth deviates from its normal path and erupts in a malposition. It is apparent, therefore, that too much stress cannot be placed on the importance of the early conservative treatment of deciduous teeth. Failing that, every means possible should be employed to save the crowns from caries, and fillings should be placed early enough to prevent the possibility of pulp infection.

The mechanism by which root resorption occurs may be considered from the standpoint both of decalcification of the inorganic salts and of proteolysis of the connective tissue organic matrix. These processes probably occur simultaneously under normal conditions, but experimental animals on deficient diets show evidence of delay in resorption; for example, in one litter of dogs[8, 9, 10] one of the animals, at necropsy, had the following teeth erupted: permanent incisors, deciduous and permanent canines, and deciduous and permanent molars. Even the deciduous teeth were firmly attached, and the permanent teeth were partially erupted, lingually, to their normal positions. Both the infected and the noninfected types of resorption, produced experimentally in animals, were described at some length in earlier reports. In addition the various factors which may delay the process or initiate it have been previously discussed and the differences pointed out between physiologic resorptions and pathologic ones arising from infection, from malnutrition, or from pressure.[11]

DIAGNOSIS AND MIS-DIAGNOSIS OF RESORPTION

Ketcham[12] has drawn attention to the fact that roots which are incompletely formed, underdeveloped, or malformed, should not be confused with resorbed roots. It is extremely rare to find malformed roots or undeveloped roots on deciduous teeth. But in the case of permanent teeth it is quite possible that some of the roentgenographic evidence that has been presented to show *resorbed* roots is evidence rather of *undeveloped* roots. Unless there is a series of roentgenographs covering several years, it is almost impossible to state, with any degree of accuracy, that one tooth has an undeveloped root and that another one has a resorbed root. A great deal of useful information on this point remains to be collected, and one of the important methods of study, in my estimation, is the use of enlargements made from the roentgenographic films. The process of making these enlargements is somewhat tedious, but in case of doubt the results are well worth the extra trouble.

PATHOGENESIS

The *normal resorption* of roots of deciduous teeth may be interfered with either by a localized injury or by disease of a systemic nature. It is possible to demonstrate not only this phenomenon, but also the formation of *new tissue* on the roots of deciduous teeth where previous resorptions have cut away perhaps one-third of the root. It has also been shown, especially on experimental animals, that diets which produce changes in bone or tooth formation *affect* likewise the *rate of resorption* of *deciduous* tooth roots. (Fig. 5.)

The process responsible in mechanical trauma for the shortening of roots on permanent teeth is more similar to the process in normal resorption of deciduous roots than to that occurring when root infection is the cause. Furthermore, from a clinical standpoint, it is apparent that appliances are not entirely to blame. As was pointed out in an introductory paragraph, the general health

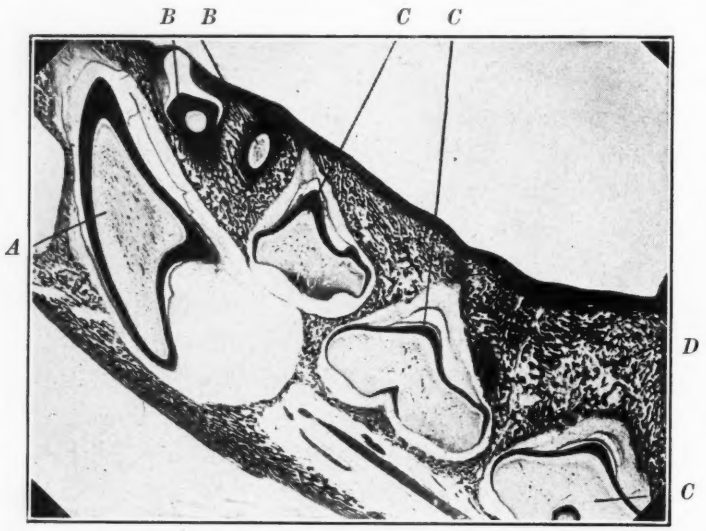


Fig. 5.—Decalcified section of mandible from dog on rachitogenic diet. The litter mates on a normal diet showed a more complete calcification of bone and tooth structure. *A*, Permanent canine unerupted and only partly formed; *B*, roots of deciduous teeth; *C*, unerupted permanent teeth; *D*, rachitic bone.

of the patient probably is of as much importance as the orthodontic treatment. Another fact, however, must not be lost sight of. From an experimental point of view there is slight evidence to indicate that certain types of appliances are more liable than others to produce resorption. There is additional information on this phase of the subject which will be presented by an accompanying series of photomicrographs.

Before proceeding with the description of the experimental portion of this report it is necessary to review briefly the normal anatomic and physiologic features of bone. From a histologic standpoint it should be recalled that the structure of bone is determined definitely by the matrix of connective tissue. In the earlier stages of development this is essentialy embryonal connective tissue, containing a great number of very delicate, fine fibrillae. The arrangement of these fibrillae at first is more like a network; at a later stage it becomes band-like in appearance. The cells, or fibroblasts, are large and are characterized

by a few prolongations which join with other processes to form cellular anastomoses with neighboring cells. Even the forming bone (i.e., in the process of formation) is readily adapted to all types of morphologic change and possesses immense possibilities of growth. The blood supply is rather variable; in some cases a great number of capillaries may be found. In other cases these are extremely few in number, and nutrition of the part takes place by diffusion. This embryonal tissue gradually becomes more highly organized and the fibrils work out into definite connective tissue framework. In the lacunae, or cavities of the bone, the cells form and disappear while the cavity remains. These lacunae are united, rather heterogeneously, by a delicate canaliculus which may contain cellular prolongations from the cells. Various types of

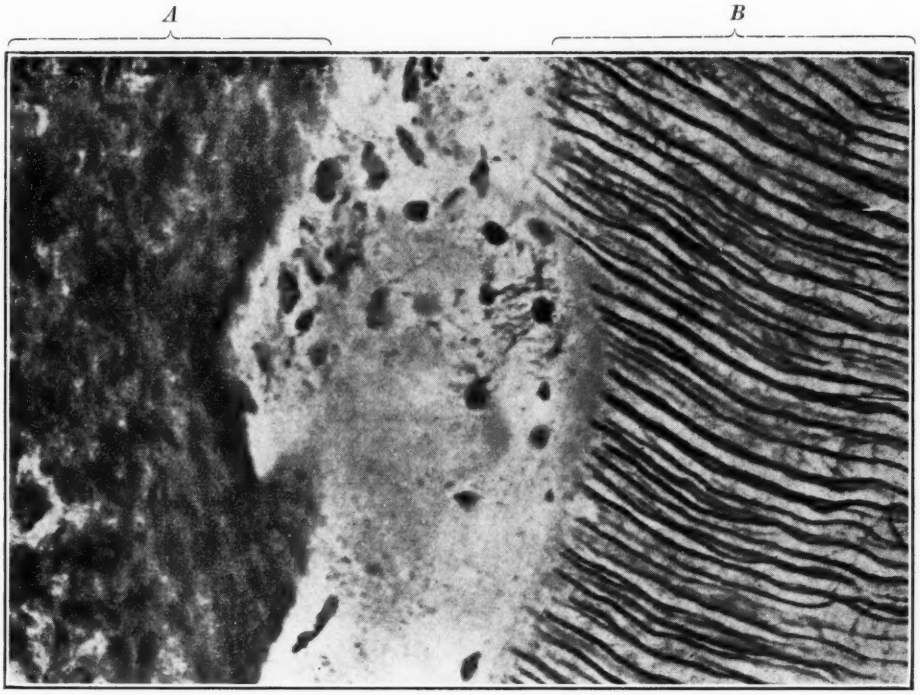


Fig. 6.—The previously resorbed area has been rebuilt restoring the root contour. The Schmorl stain in this decalcified section demonstrates the structural elements both of modified dentin and of rebuilt cementum (×400). *A*, Peridental membrane; *B*, dentin matrix; *C*, dentin fibril.

bone are recognized, but all consist essentially of three tissue elements, namely fibrillae, bone cells, and matrix. The most unstable type of bone is embryonal, found in the framework of the matrix. It is the same type of tissue as that spoken of under the term "young bone."

The second type of bone is arranged like bars or plates, with irregularly placed spaces. The framework is somewhat thicker than that of embryonic bone and the spaces are larger. The lamellae forming the bars and the plates of the spongy bone contain both lacuni and canaliculi. The heaviest type of bone is the compact bone. It has a very thick framework and is formed of a great number of lamellae so closely placed that the connective tissue spaces are exceedingly small. All three types of bone may be present simultaneously in various localities of the maxilla or mandible.

The bone and tooth lesions so far experimentally produced in this research by the application of mechanical force have been those which resulted from the following movements of teeth:

1. Separation or tipping of crowns in the mesiodistal direction.
2. Extrusion of tooth from the alveolar process and intrusion.
3. Tipping of molars.
4. Rotation of teeth.
5. Bodily labial movement.
6. Bodily palatal movement.

Histopathologic specimens, prepared from maxillary permanent central and lateral incisors and first molars have shown that the lesions produced in the laboratory are comparable to the lesions secured from the clinic.[13-18] The important part of the research, however, deals not so much with the demonstration of the pathogenesis of resorption, but rather with the evidence of rebuilt tissue where previous loss of tooth structure has been relatively severe. Although resorbed areas were produced in varying degrees, the severity of the lesion, in every case, was less in those animals where no restriction of diet had been imposed. (Fig. 6.) Furthermore, it has been clearly proved that animals on deficient diets show greater areas of resorption and correspondingly lesser areas of rebuilt tissue. In support of this statement it is necessary only to cite protocols of several experiments.

RESORPTIONS DUE TO BODILY MOVEMENT

Several facts have appeared in the mass of new material. Monkey No. 90, aged approximately thirty-one months (corresponding human age thirteen years), was put on deficient diet in October. A labial arch wire and bracket bands were placed on the four maxillary permanent incisors. The tension on the arch wire was such as to produce bodily movement in the labial direction of both the left and the right lateral incisors, and a slight bodily movement in the lingual direction of the right and left central incisors. (Figs. 7 and 8.)

After the appliance had been in position for a week, the tension on the right lateral incisor was slightly increased. A week later the animal was given a regular diet on account of a loss in weight. When this loss was regained (about ten days), the restricted diet was substituted for five days; then discontinued and the animal returned for a second period of a week to the regular diet.

The appliance was examined regularly, and notations were made as to the direction of the movement of the teeth and also the extent. The experiment lasted one hundred and four days, which corresponds to fourteen months human age. At its conclusion, it was observed that the right lateral incisor had moved labially so as to be completely out of occlusion. There was also a slight mesial rotation. The right central incisor had moved toward the palate and showed the effects of a severe occlusal trauma. There was a little mesial rotation. The outstanding fact was that the incisal enamel on the labial aspect was worn through and only the portion of the lingual enamel remained.

The left central incisor showed slight intrusion and lingual movement, resulting in an edge-to-edge bite. The left lateral incisor had also been moved bodily in a labial direction to such an extent that it was out of occlusion. (Figs. 9, 10, and 11.)

Fig. 7.—Bands and wire on labial surfaces of the four permanent maxillary incisors.

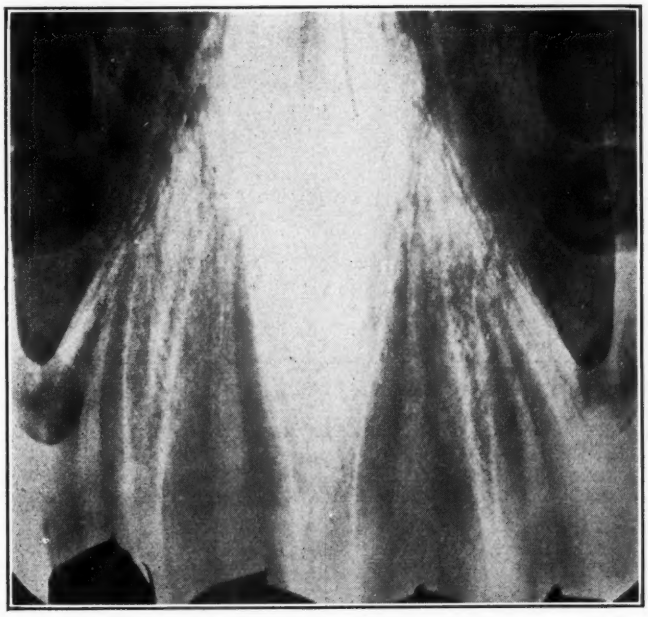


Fig. 8.—Enlargement from roentgenograph showing the position of the appliance and the completed calcification of the four permanent incisors.

Histopathologically the sections of the lateral incisors showed marked resorption on the labial aspect of the root and no evidence of rebuilt tissue. In the pulps in these teeth there was only slight evidence of inflammatory re-

action. (Fig. 12.) It will be recalled that in teeth from other animals on deficient diets, pulp stones or pulp nodules were frequently demonstrated. There was a marked inflammatory reaction in the peridental membrane. (Fig. 13.)

Resorption both of bone and of tooth structure occurred, but not in the same areas. At those places on the tooth where cementum and dentin had been resorbed, it was found that bone persisted in the vicinity of the resorbed areas.

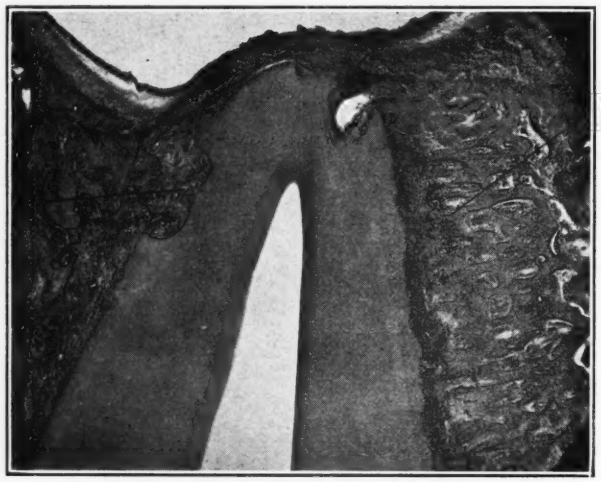


Fig. 9.—Left maxillary permanent lateral incisor, moved bodily in a labial direction. Note the resorption on the labial aspect. On the palatal side both fibers and bone have been pulled and stretched. *A*, Resorbed area on labial aspect; *B*, palatal aspect, the position and direction of bone indicate the amount of tooth movement.

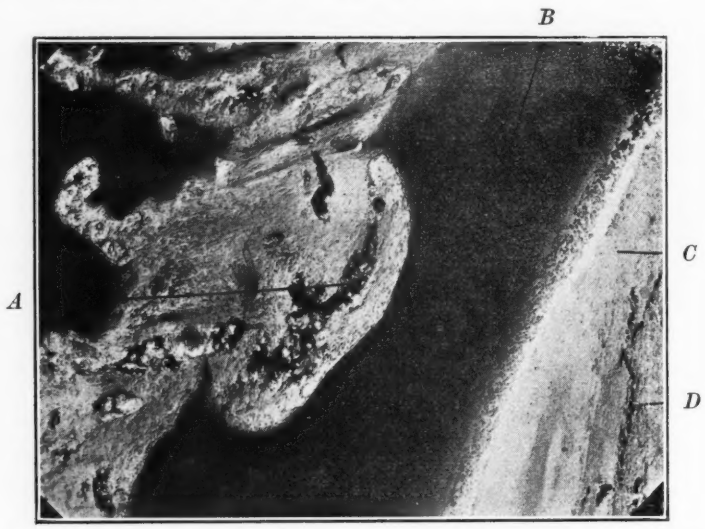


Fig. 10.—Blood capillaries in the resorbed area *A*, Resorbed area and capillaries; *B*, dentin matrix; *C*, pulp tissue; *D*, pulp capillary.

Similarly, those portions of alveolar bone which show resorption do not usually lie adjacent to a resorbed area on the tooth structure. On autopsy some slight amount of fluid in the pleural cavity was present, but death had resulted from intestinal obstruction brought about by ulcers in the cecum.

In another animal the following movements were secured: on the right maxillary permanent central incisor, extrusion and tipping of crown in mesial

and palatal direction. This appliance rapidly produced resorption of the distal aspect of the root as well as of the adjacent bone. In certain areas, however, the peridental membrane had been pressed so tightly against the alveolar wall that the bone was contiguous with the cementum. Indeed, at the point of

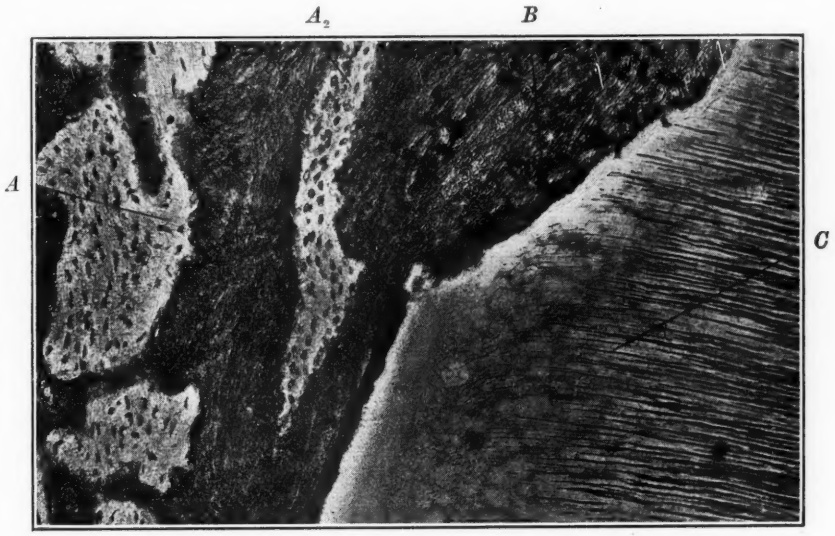


Fig. 11.—Deep labial resorption. Fragments of bone A_2 persist in areas adjacent to the resorbed area on the root. *A*, Alveolar bone; *B*, resorbed area on root; *C*, dentin matrix.

Fig. 12.—The pulp shows only slight evidence of inflammatory reaction.

greatest pressure the resorption was so great that the bone was directly adjacent to dentin. There were no intervening fibers of peridental membrane or cementum matrix.

ENAMEL MATRIX

One of the very interesting side lights studied in this research deals with the histology of the decalcified enamel matrix. The decalcification of hard structures presents many difficulties in technical manipulation. One of the

most important of these is to stop decalcification before the soft tissue framework or matrix becomes macerated, thus losing the identity of the tissue elements. It is, of course, equally necessary to carry the decalcification far enough so that the microtome knife will not encounter hard substance. By using weak solutions and testing regularly for phosphate, this decalcification can be easily stopped before the maceration of organic matrix occurs. These technical details have been described in an earlier report.[10]

It is probable that the formation of enamel matrix begins about the same time as the formation of dentin matrix, and that the fibers of each tissue form equally fast. It is equally probable that in cases of malnutrition this uniform rate may be interfered with and the one tissue or the other proceed to lay down fibers at a greater rate. For example, it was noticed in one experiment that the enamel matrix is nearly three times the width of the dentin matrix at the tip

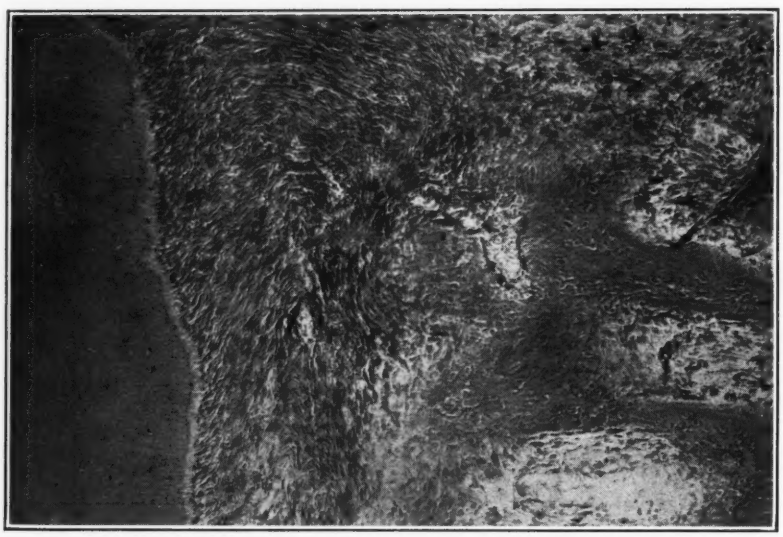


Fig. 13.—Extensive fibrous tissue reaction on the palatal aspect of the root. No resorption of root or of bone. *A*, Palatal aspect of root; *B*, bone.

of the cusp. Such a histologic specimen, naturally, might be obtained also if the direction in which the sections were cut was not exactly parallel to the long axis of the tooth. Under such circumstances, the relationships of the dental papilla to predentin and dentin would show that the direction of the cutting was at an angle; but this does not appear to be the case. (Fig. 14.) The enamel matrix, as demonstrated with the Schmorl and van Gieson stains, is much more dense than dentin and overstains in some areas to such an extent that it is quite impossible to follow the structural tissue elements. There seems to be a greater tendency for the Schmorl stain than the van Gieson stain to precipitate. (Fig. 15.)

Comparisons of dentin and enamel matrices indicate that approximately twenty fibers of enamel matrix occupy the same linear distance on the photographic enlargement as ten fibers of dentin matrix; that is to say, the enamel

fibers and the spaces between them are about half as large as the dentin fibers. At the junction with the dentin they are regular in direction and arrangement; but as the tooth surface is approached, the lines become much more wavy, crooked, and irregular. This irregularity is emphasized by the increased amount of coloring matter from the stain that remains in the section. In some areas

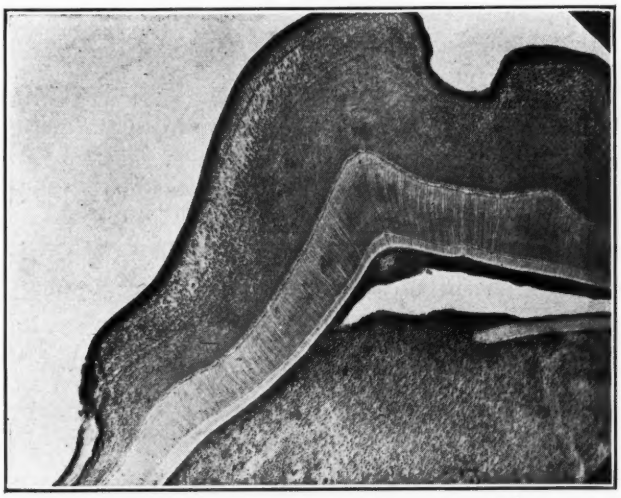


Fig. 14.—Decalcified molar showing the enamel and dentin matrices.

Fig. 15.—Higher magnification of the enamal matrix, dentin matrix, predentin, and a portion of the periphery of the pulp.

the color is quite like blotches, very similar, in fact, to the staining reactions described by Mummery in his experiments with *Sargus Noct.*

It would seem to be a fruitful field of investigation if further studies on the subject of enamel matrix could be carried out, for it would be especially interesting, from the clinical standpoint as well as from the experimental, to observe what effects deficient diets may have in the etiology of enamel hypoplasia, caries, and erosion.

PROGNOSIS AND TREATMENT

In the histopathologic examination of the material, there is one fact of importance to be emphasized from the standpoints of etiology, prognosis, and treatment. Resorptions of bone or of tooth substance occur more readily when the animals are on deficient diets, or are suffering from some metabolic or infectious disease. The fact that resorptions occur on teeth which have never been treated orthodontically and which appear normal in every other respect, indicates that the process must be considered either as a phase in maldevelopment of the arch and of the alveolar process, or, second, as a lesion which may have been produced by any one of several causes.

It is well known that during the early years of adolescence the positions of the erupting teeth change as the jaws attain their growth. Such changes naturally involve realignment of the teeth. This developmental phase is contingent upon the growth of bone in some areas, and on resorption of bone in others. Similarly the resorption and rebuilding of certain portions of the root are in many instances a part of growth phenomena. The process of rebuilding the resorbed tissue, both bone and tooth structure, depends to a large extent upon the general state of nutrition of the patient.

Suggestions are being made that dentists prescribe thyroid or pituitary preparations in cases where glandular dysfunction appears to be an etiologic factor. To follow such advice is to invite disaster. It is not the duty of the dentist or the orthodontist to treat cases of malnutrition. This is a medical problem. Curiously enough the idea seems to be firmly fixed that the treatment of malnutrition merely is to correct a faulty diet. Such is far from the case. I have emphasized on many previous occasions[17, 19] that malnutrition is not concerned solely with the lack, or the disproportion, of nutritive elements, nor can it always be treated by dietary therapy alone.[20, 21] Furthermore, to dose in a haphazard manner with endocrine preparations is to assume a burden of responsibility which few physicians, and certainly no dentists, are qualified or trained to bear. In fact, the thyroid cases, so called, do not show any remarkable improvement, perhaps because the diagnosis was wrong in the first place.

This angle of the problem deserves more clinical study. Although animal experiments usually point the way, it is not safe to rely too much on laboratory results; but from the laboratory standpoint, one is certainly justified in concluding that the successful treatment of many orthodontic cases is a problem not only of the orthodontist but also one which should be shared by the pediatrician.

SUMMARY

Radicular resorptions are classified in accordance with the etiology into two main groups as indicated in Table I.

The resorptions listed as I a, occurring in conjunction with the other growth phenomena, are essentially normal in character, rather than pathologic,

TABLE I

CLASSIFICATION OF RADICULAR RESORPTIONS

I. Noninfected type
   a. Normal resorptions of growth phenomena.
   b. Pathologic resorptions arising from malnutrition, or metabolic disease, as rickets, etc.
   c. Pathologic resorptions due to occlusal trauma.
   d. Pathologic resorptions due to mechanical trauma of an undetermined degree.

II. Infected type
   a. Local. Pathologic resorptions due to infection from the pulp canal of the tooth or from adjacent teeth.
   b. General. Pathologic resorptions arising from an infection of a systemic character: e.g., tuberculosis, syphilis, etc.

and require no treatment, but sometimes are incorrectly diagnosed. Those listed under the other headings are pathologic and most of them preventable.

The clinical diagnosis of resorption may be made from a series of roentgenographs taken several months apart. Several angles for each tooth are necessary. From these roentgenographs, photographic enlargements may be made and used as a basis of further study. Mis-diagnosis of undeveloped roots may be avoided by comparing a series of such enlargements collected over a period of several years.

The treatment of some of these resorptions may be either general or local in character, or both. The general treatment is conducted under the supervision of the pediatrician. Cases of malnutrition, from either hemoglobin or red blood cell deficiencies, demand constant and expert attention. Similarly, the cases in which calcium phosphorus balance is abnormal belong specifically to the physician. Is it not necessary to suggest that a complete physical examination be made which will include the various laboratory tests—an examination which should be periodic if the orthodontic treatment extends over a year?

The local treatment usually is simple. If an infection from a pulp canal has developed, let the tooth and canal be sterilized and filled properly; or failing that—extracted.

In cases of occlusal or mechanical trauma, the force should be relieved, or even removed entirely. This part of the research, however, is incomplete and requires further study and experiment.

REFERENCES

1. Noyes, F.: Dental Histology and Embryology, Philadelphia, 1915, ed. 2, p. 252 et seq., Lea & Febiger.
2. Black, G. V.: Special Dental Pathology, Chicago, 1915, pp. 330-333, Medico-Dental Pub. Co.
3. Hopewell-Smith, A.: Dental Cosmos 72: 912, 1930.
4. Orban: Dental Histology and Embryology, Chicago, 1928, pp. 175-181, Rodgers Printing Co.
5. Kronfeld: Histopathology of the Teeth, Philadelphia, 1933, p. 228 et seq., Lea & Febiger.
6. Marshall, J. A.: Diseases of the Teeth, Their Diagnosis and Treatment, Philadelphia, 1926, Lea & Febiger.
7. Idem: Physiol. Rev. 4: 564, 1924.

8. Idem: Changes in Tooth Structure Resulting From Deficient Diets, J. A. M. A. **81**: 1665, 1923.
9. Idem: The Effects of Nutritional Disturbances Upon Calcification and Decalcification of Teeth in Experimental Animals, J. A. D. A. **11**: 6, 1924.
10. Idem: Dental Caries and Pulp Sequelae Resulting From Experimental Diets, J. A. D. A. **14**: 3, 1927.
11. Idem: Comparison of Resorption of Roots of Deciduous Teeth With the Absorption of Roots of Permanent Ones Occurring From Infection, Pacific D. Gaz. **36**: 597, 1928.
12. Ketcham, A. H.: A Preliminary Report of an Investigation of Apical Root Resorption of Permanent Teeth, INTERNAT. J. ORTH. **13**: 97, 1927.
13. Marshall, J. A.: Studies in Apical Absorption of Permanent Teeth—I, INTERNAT. J. ORTH. **16**: 1035, 1930.
14. Idem: Osseous Changes Due to Pressure Trauma, Proc. Soc. Exper. Biol. & Med. **27**: 270, 1930.
15. Idem: Root Absorption of Permanent Teeth—a Study of Bone and Tooth Changes Incident to Experimental Tooth Movement, J. A. D. A. **17**: 1221, 1930.
16. Idem: Studies on Apical Absorption—II, INTERNAT. J. ORTH. **16**: 1035, 1930.
17. Idem: Relation of Malnutrition to Dental Pathology, INTERNAT. J. ORTH. **17**: 527, 1931.
18. Idem: Comparison of Normal and Pathologic Bone in Alveolar Processes of Maxillae, J. A. D. A. **18**: 1591, 1931.
19. Idem: Dietary Prescriptions by Dentists, Dental Cosmos **73**: 892, 1931.
20. Idem: Deficient Diets and Experimental Malocclusion Considered From the Clinical Aspect, INTERNAT. J. ORTH. **18**: 438, 1932.
21. Idem: A Study of Bone and Tooth Changes Incident to Experimental Tooth Movement and Its Application to Orthodontic Practice, INTERNAT. J. ORTH. **19**: 1, 1933.

DISCUSSION

Dr. A. H. Ketcham, Denver, Colo.—I cannot discuss this paper scientifically. All I can do is to try to express our appreciation of the vast amount of work and the conscientious manner in which Dr. Marshall has conducted this research for us without any remuneration to himself.

The research, I feel, has been successful in showing that resorptions were produced on the teeth of experimental animals under certain conditions, and under other conditions were not produced, at least not to anywhere near so great a degree; also, that animals on a full diet recovered practically from the effects of orthodontic tooth movement, while those upon deficient diet did suffer to a greater extent and did not make much, if any, recovery.

It is our hope that at some future time extension of this research may be undertaken in which the different types of orthodontic appliances exerting measured pressure may be used. With the knowledge gained through this experiment as a foundation, further research work could be carried on.

Dr. L. M. Waugh, New York City.—As we reach the quarters of our knowledge, of additional information, the horizon of our vision broadens through research in matters pertaining to health. Those not particularly experienced in research or aiding in research programs are impatient when positive results are not obtained, and yet negative results are often much more valuable than positive ones.

In this particular instance, this impressive piece of research work, extending over this period of five years, has brought us a negative result. I rejoice that it is negative because it would be a rather sad case for scientific research if this investigation had proved that tooth roots are resorbed. Dr. Marshall has shown rather conclusively, and has been checked and corroborated by researches in other laboratories, that resorption of roots is not a matter of tooth movement by orthodontic appliances. So this negative finding is a very happy one for us.

We have expended the money our Society has subscribed by assessment for this work. The question of our appropriating additional moneys from our treasury was discussed. Five years ago, when it was proposed that we take money from our funds accruing from membership fees and from dues, the Society would not allow it. The members would not vote for an increase in dues, but they did vote an assessment of $10 per year per member. That money has now been expended.

Personally, I could not, as one of the Executive Council, endorse asking you as a Society to withdraw additional moneys for this continued work.

Dr. Ketcham has told us there is material in the laboratory which it might be fine to have sectioned. He is not sure that the sectioning of this additional material, a large percentage of which has already been prepared for the presentation of slides, would give us anything definitely different.

However, I feel that if we could arrange to help Dr. Marshall in some way, it might be a fine thing to do. We are not helping Dr. Marshall. We are helping ourselves.

If there are any members of this Society who would like to volunteer, say, $100, or $10, I should like to be one. I want Dr. Marshall and Dr. Ketcham to know that to that extent I have an interest in helping to continue the study of the material.

This research has been a very fine thing for us. I remember when Dr. Ketcham first, in his radiograms, discovered that the root ends of certain teeth were gone. He wrote to Dr. Young and he wrote to me, and I suppose he wrote to a goodly group of the older members and said this thing was happening and that he was going to publish a paper. Quite disturbed, Dr. Young came to me and asked, "What do you think, if we publish a paper and have it get about that our appliances are causing roots to be resorbed? What would be the reaction of the dental profession?"

I said, "I can't believe we are going to do the harm ourselves. I think it is going to be a terrible blow to orthodontia."

I think Dr. Young's information was deterred in Dr. Ketcham's reports. For two years Dr. Ketcham did not report this. In the meantime, research was instituted.

This fine piece of work saves the orthodontist from condemnation which would have been given him, but in the light of research and science the fault was found not to be his.

I feel this has been a very valuable research, and if one hundred men want to give $10, or if half that number want to give more, up to the extent of twenty subscribing $50, I should be glad to be one of them, even though I do not feel I could conscientiously endorse the expenditure of money regularly coming into our treasury. I do not think we should vote on that because there are so few of us representing the whole Society.

I want to express my appreciation to Dr. Marshall. I think he has done a gigantic piece of work. As a Society, I think we must sincerely express our gratitude to the University of California for the funds they have spent, much more than we did, mind you, in allowing some of their workers to do this work for us.

Shall I move, Mr. President, that our Secretary draft an appropriate letter expressing our gratitude to the University of California for detailing Dr. Marshall and his laboratory to this problem?

The Society is fully appreciative of the persistent interest and faithful effort of Dr. Ketcham, as chairman of the Research Committee, and desires here to record its deep gratitude.

Dr. Casto.—I second that motion and in doing so I wish to express to Dr. Marshall my sincere appreciation for his devotion to this piece of research work for the American Society of Orthodontists.

Dr. Kelsey.—Dr. Waugh said so fully what I should like to say that there is no necessity for repeating it.

I might call attention, however, to the fact that I have supported a movement to have this research continued from the time of my own presidential address two or three years ago in St. Louis until the present time. I feel we have derived great benefit from it, as Dr. Waugh says, and we are grateful to Dr. Marshall and to the University of California.

I should be glad to be one of a certain number to make a small contribution.

President Flesher.—You have heard the motion made by Dr. Waugh and seconded by Dr. Casto. Is there any question or further discussion? If not, those in favor signify by saying "aye"; contrary "no." It is carried.

Dr. George Grieve, Toronto, Canada.—Dr. Marshall, I should like to ask just one question concerning the instance where you said the pulp of the central incisor was destroyed. In your investigation, you did not find any further resorption on any of these cases where the pulp did die? You said that in some instances resorption resulted from carrying the root forcibly against the other tissues, and in this one instance death of the pulp occurred. But in other instances, where there was no death of the pulp, was there rebuilding of that root material?

Did you get any rebuilding of tooth material after the destruction of the pulp; or did you find out whether there was any further destruction of the tooth material in the tooth with the dead pulp?

Dr. John A. Marshall.—There are only one or two instances in which death of pulp occurred. Of course, there are no clinical methods available or any other means of communication between a laboratory animal and dentist. So far as the function is concerned, I had no subjective symptoms or other means of knowing when pulp death occurred.

But the resorptive processes which I have observed have been due not to the pulp so much as to the peridental membrane. The fact that the pulp died is just one of those things that happens in the course of treatment, so to speak.

I cannot visualize that the pulp itself has any particular function so far as resorption of cementum is concerned. If there were resorption of the canal wall, that would be a different story. We know that chronic inflammatory reaction of a pulp will cause resorption from within outward in the pulp canal.

Dr. Grieve.—I think I have seen instances where there has been root resorption of some incisors, and where the pulp of one of those incisors was dead. There was no resorption of the pulpless tooth, but there was resorption of those teeth carrying vital pulps. The point in my mind is this: is not the resorptive process brought about partially by the pulp of the tooth?

Dr. Marshall.—Perhaps the original stimulus might come from pressure at the apical foramen, but, as I say, I have no means of telling in the laboratory when the death of that pulp occurs, or when the pulp is inflamed, because the monkey won't tell you that the tooth is sore or that it hurts. Sometimes his teeth are a little loose from the movement, but that is the only clinical observation that can be made on that point.

I want to thank particularly Dr. Waugh, Dr. Kelsey, Dr. Ketcham and Dr. Casto for their very kind remarks.

I want to correct one statement that Dr. Waugh made. The University of California has appropriated money, but not nearly so much money as the American Society of Orthodontists has appropriated. The major part of the expense has been borne by the Society.

I have been somewhat amused at one or two statements in the various periodicals, which have stated that the pressures we used were extreme. I have not made at any time a direct statement about the amount of pressure that has been used. Dr. Allen Scott and Dr. Grover, in adjusting their appliances, used what in their judgment was the minimum amount of pressure. The first monkey we operated on, we did not understand that, and we did use too much pressure, but that was the only time I made any definite statement to that effect.

Perhaps some of you will recall that that extreme pressure produced fracture of the alveolar process between the two central incisors.

So any statements you see in books, in one particular book I have in mind, about extreme pressures being used, are figments of the imagination of the man who wrote it.

I want to say again that I have enjoyed tremendously the work of your Society. I am, of course, extremely sorry that it is over. That is something which neither you nor I can help. We have to put that on the world economy program, which unfortunately we cannot change.

I want again to thank this Society for permitting me to go on with this program of research. I think, as Dr. Waugh has pointed out, the fact that the result has been negative will help orthodontics a long way.

CLEFT PALATE AND HARELIP: AN ADOLESCENT CASE TREATED ORTHODONTICALLY IN CONJUNCTION WITH A LIP-STRETCHING DEVICE AND SKIN GRAFTING OF THE LABIAL SULCUS*

E. A. HARDY, L.D.S., M.R.C.S., L.R.C.P., LONDON, ENGLAND

THIS boy was brought to me at the age of about thirteen years. He had a double harelip and cleft palate operated upon and the cleft closed in

Fig. 1.

Fig. 2.

infancy. The premaxilla was, however, free from the major portion of the jaw. The condition at his first attendance was as follows:

*Transactions of British Society for the Study of Orthodontics.

An extremely nervous and apprehensive child (Fig. 1), a severely contracted arch, a microstomia due to a very scarred upper lip which was adherent to the premaxilla (Fig. 2). He was so scared that he cried at almost anything; even to an impression being taken with "Stent" on two fingers (Fig. 3). The mouth opening was so limited by the scar and the attachment to the pre-

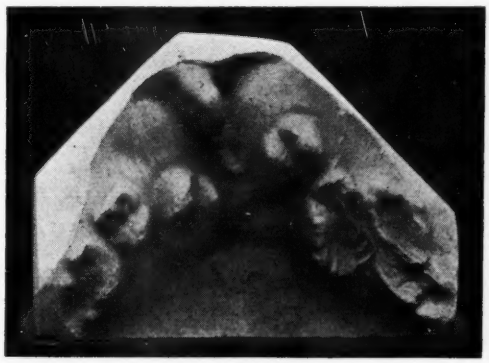


Fig. 3.

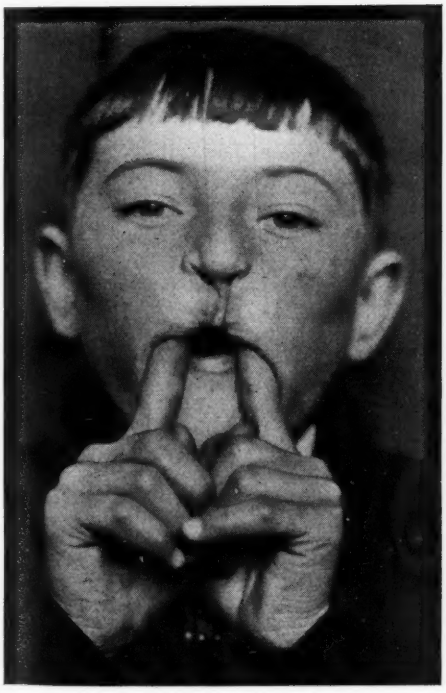


Fig. 4-*A*.

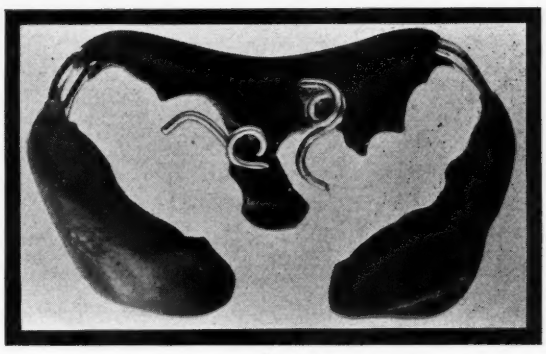
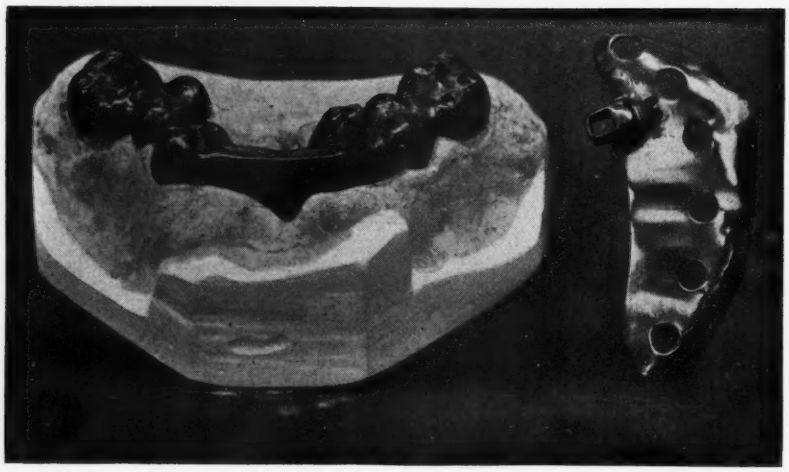


Fig. 4-*B*.

maxilla that this was the only method I could adopt. From that model I was able, by means of a special tray of very limited dimensions, to obtain an impression of the palate and lingual surfaces of the teeth only, at the second visit. After stretching the lip (Fig. 4*A*) by the apparatus (Fig. 4*B*), I was able to obtain a more perfect impression (Fig. 5). It was decided to deepen the labial sulcus by skin grafting in order to free the attachment of the lip

to the premaxilla. The usual cap splint was prepared (Fig. 6*A*) with a detachable piece (*B*) to hold the "Stent" mold. A successful skin grafting was performed by Sir Harold Gillies, which allowed of more stretching of the lip (Fig. 7). While keeping the excellent sulcus distended (Fig. 8), I began the initial expansion of the palate. Orthodontic possibilities in a boy of this age caused me some perplexity as to the time I could safely wait and yet have time

Fig. 5.



A. *B.*

Fig. 6.

to complete a somewhat considerable expansion. As you know, these skin grafts have to be prevented from contracting until they are well established, and the time it takes is an unknown quantity and varies with the type of individual, the quantity of scar tissue present, and the thickness of the graft. This perplexity made me rack my brains to discover a method to do both at the same time. Fig. 9 shows the plate I devised for this purpose. This method was used until a Badcock screw plate could no longer perform its function

(Fig. 10). I was therefore forced to use fixed appliances. It is here that fixed appliances have their greatest scope. The skin graft was sufficiently well established, so that it was quite in order to proceed in this way. We still

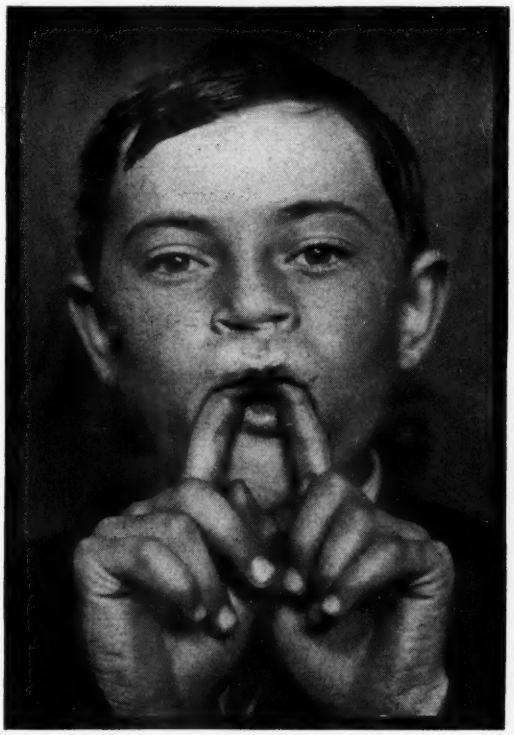


Fig. 7.

Fig. 8-*A*.

Fig. 8-*B*.

Fig. 8-*B*.—Prosthetic vulcanite mold which keeps sulcus distended.

had to complete the expansion across the molars, and the Badcock refused to do any more. Second, the most important change of all, i.e., to change the shape of the arch from that of an inverted V into an inverted U. Third, to retract the canines.

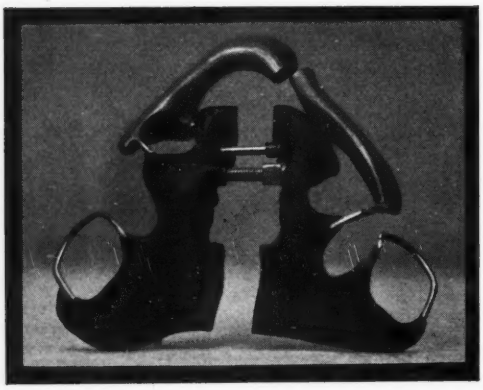


Fig. 9.—Lip, sulcus and jaw stretching appliance.

Fig. 10.

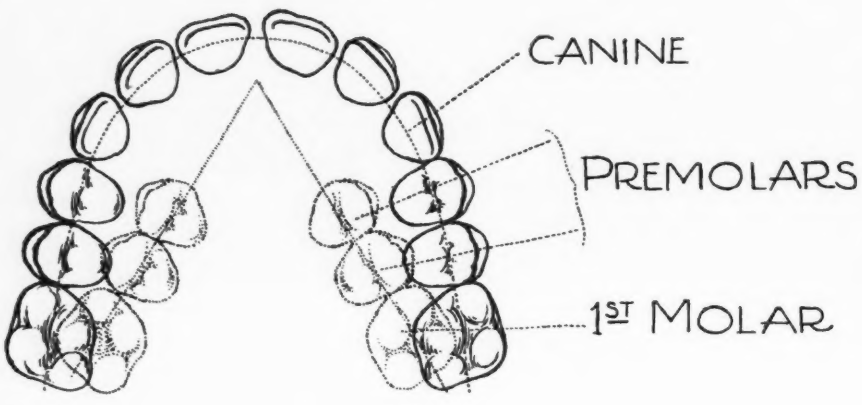


Fig. 11.

Fig. 11 is a diagram showing the normal arch as compared with that frequently seen in cleft palate cases.

Badcock screw plate expands the arch, but still retains the V shape, whereas the fixed appliance can stretch the whole maxilla apart, more at the

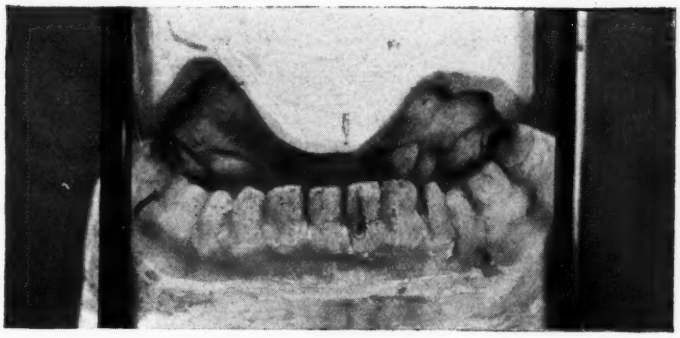


Fig. 12-*A*.

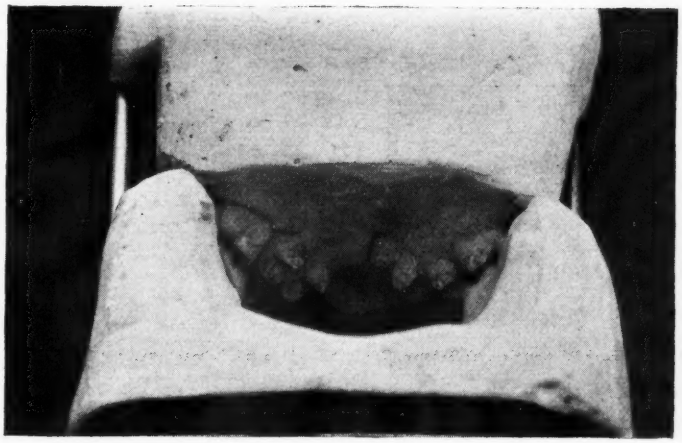


Fig. 12-*B*.

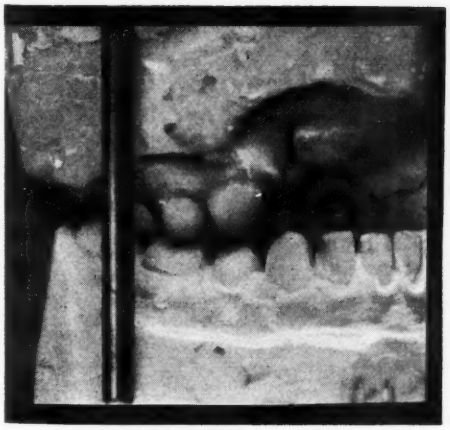


Fig. 13-*A*.

Fig. 13-*B*.

apex of the V than across the molars. This produces the same effect as rotation without its being a tooth movement. When one limb of the V has to be pushed farther than the other, the fixed appliance is of inestimable value.

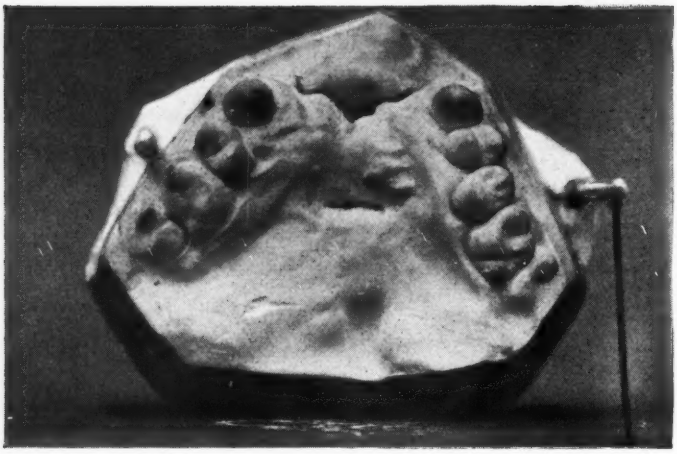


Fig. 13-*C*.

Fig. 14-*A*.

Fig. 14-*B*.

Fig. 14-*C*.

Fig. 14-*D*.

To Miss K. C. Smyth, who designed and made the first of the fixed appliances, I am very much indebted. I shall always be deeply grateful to her for my initiation into fixed appliance work.

Fig. 12 shows the occlusion *before* treatment.

Distance between $\frac{3|3}{}$: 14 mm.
" " $\frac{5|5}{}$: 23 mm.
" " $\frac{6|6}{}$: 29 mm.

Fig. 13 shows the occlusion *after* treatment.

Distance	between	$\frac{3\|3}{}$:	37 mm.,	an	increase	of	23	mm.
"	"	$\frac{5\|5}{}$:	41 mm.	"	"	"	18	mm.
"	"	$\frac{6\|6}{}$:	39 mm.	"	"	"	10	mm.

Fig. 14 shows the patient wearing denture to supply $\frac{321|12}{}$, and x-ray pictures before, during, and after treatment.

The special points to be noted are:

1. That orthodontic treatment per se improves the facial contour. (Compare Fig. 1 with Fig. 10.)

2. That movement can take place in the maxilla as a whole at the intermaxillary, interpalatal sutures, and the sutures between the frontal process of maxilla and the malar, nasal, lachrymal and frontal bones. (Dr. Wright of Boston, *Dental Cosmos,* June, 1931—March, 1932.)

3. The amount of expansion that can be gained.

4. The tight vermilion border of upper lip can be stretched forward to its normal position.

5. The conversion of arch from that of the inverted V to the inverted U.

DISCUSSION

Mr. George Northcroft congratulated Mr. Hardy on the cinematographic presentation of his communication. It was a very interesting method of disl laying any work of this kind. The case had been recorded with extreme care, and the example was one which might be followed in other carefully worked-out cases. In 1914, at the Sixth International Dental Congress, he had shown a case where he believed he had expanded the maxillary suture, using rapid expansion. Dr. Matthew Cryer of Philadelphia was present on that occasion, and discussed his paper, pooh-poohing the idea altogether. He himself, being younger then than he was now, was rather hurt that his ideas as to expansion of the maxillary suture should have been refuted by such an authority. It was explained that if the suture was expanded there would be a disarticulation of all the different bones of the superior maxilla, and this view in theory might sound good reasoning. In practice, however, the amount of bending at the site of the various sutures must be extremely small. Of course, in the case of cleft palate it was a little different because the bones were already collapsed, and the articulation of the palatal processes of the maxilla would not be interlocked. He thought that Mr. Hardy had brought forward a very interesting case, and there was no doubt as to the satisfactory result of the expansion.

Mr. A. T. Pitts said that he had been extremely interested in the demonstration. He had seen a large number of these cases and had done a certain amount of orthodontic treatment on them, and had even written on the subject. He thought that such treatment had its severe limitations, and he was not so enthusiastic about it as he used to be. His experience had been that one might get what appeared to be a marvelous degree of expansion,

but there was a tendency to collapse. It was not possible to get anything of a stable character. Even after years, when one had put in a denture, and the denture was left out for a day or so, the arch tended to collapse. There was no doubt, of course, that one pushed the bones apart. Seeing that all these children did have to wear a denture, there was, at the same time, a case for carrying out a certain amount of expansion which resulted in a greater degree of room for the tongue, an important matter from the point of view of speech, and helpful also to the occlusion. But he felt that the orthodontic treatment had to be subsidiary to the prosthetic treatment at a later day, and should be only taken with the idea of making the prosthetic treatment more successful. He had been particularly interested in the apparatus for stretching the lip. This was extraordinarily ingenious, and, he would imagine, efficient. It was one of the things most important in these cleft palate cases, because a denture was needed, and it had to be a denture of considerable bulk. If the lip was stretched, the patient could better tolerate the denture. He had a case of a patient who had been coming to him for over twenty years; he had a palate which was worse than flat; it was convex downward. His upper lip was more than one inch behind his lower lip. He wore a denture, a most extraordinary object, an enormous mass of vulcanite, replacing the whole of the premaxilla. The palatal surface was nil. There were no bands or wires to hold it up. The patient simply kept the thing in position by his prehensile lip. Yet, when he had him first, as a boy, the lip was tightly stretched across. He did not use any lip-stretching appliance, but by using increasing thicknesses of vulcanite he had found it perfectly easy to stretch the lip almost to any amount required.

The *President* thanked Mr. Hardy for his communication and also for the manner of its presentation. He believed that the cinematographic method would be used increasingly by those who desired to illustrate their cases. As regards the age up to which treatment was possible, he did not think there was any age limit. The limiting factor was the amount of work and time which the treatment occupied. The older the patient the more slowly must the teeth be moved. With regard to what Mr. Pitts had said about expansion, if one expanded the mouth and did nothing more, some artificial force must be interposed to maintain the expansion. With regard to extraction, it was a good thing sometimes to retain a tooth in the palate for the plate to rest on rather than to let it rest on the soft tissues.

Mr. E. A. Hardy thanked those who took part in the discussion and said that he was very glad to hear the President's remarks as to the age at which one could begin and finish the expansion. He inquired whether the President was referring to expansion of the jaw or just tooth movement. The President replied that he was referring to tooth movement. Mr. Hardy then asked whether in regulating the teeth the President would attempt any complete movement of the whole jaw. The reply was in the negative.

THE CRISIS IN ORTHODONTIA*†

Part I

2. Tissue Changes During Retention. Skogsborg's Septotomy

Albin Oppenheim, Vienna, Austria

(Continued from page 644, July)

In fighting certain habits which are usually done unconsciously, it is a good method to substitute other antagonistic habits and to concentrate the attention of the children upon these new habits. Thus the attention of the child is directed toward the unconscious muscle innervation. However, it must be emphasized that this fight against habits is sometimes of very long duration

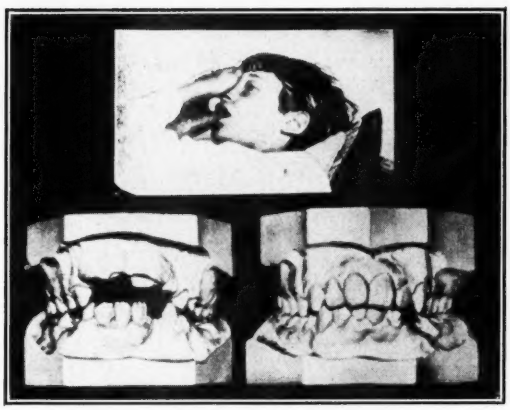


Fig. 20.—Spontaneous correction of an anomaly following discontinuation of the habit shown. (Collection of Grünberg.)

and requires full attention and patience on the part of the parents and of other adults dealing with the child patient. Until the fight against habits has been carried through successfully, no treatment should be started. In many cases it even happens that after the habit has been discontinued, no other treatment is necessary, since many anomalies correct themselves after the etiologic habit has been discontinued. This experience has been substantiated by many references in literature and is known to every experienced orthodontist.

To illustrate this statement three cases from the collection of Grünberg will be shown. In one of these cases, Fig. 20, the eruption of the maxillary four incisors was prevented by the habit illustrated. Within one and one-half years after the habit had been discontinued, these teeth erupted spontane-

*From the Department of Orthodontia of the Dental Institute of the University of Vienna.

†Translated from *Zeitschrift für Stomatologie,* Nos. 7 and 8, 1933, published by Urban and Schwarzenberg, Vienna and Berlin.

ously. In the second case (Fig. 21) we find, on the right side, a typical deformity due to thumb-sucking which corrected itself without any treatment, after the habit had been discontinued.

If one has been successful in breaking a habit partly by psychic influence, partly by cuffs which make thumb-sucking impossible, one must give nature time to correct the anomaly. Immediate active therapy is unnecessary, and certainly not better than the natural reaction of the organism. Although Kantorowicz suggests "the same therapy for protrusion or open bite due to thumb-sucking as for protrusion due to crowding," although Herbst, in discussing the appliance for the thumb-sucking habit, the result of which is shown in Fig. 22, came to the conclusion that "this case is a difficult one," still I would

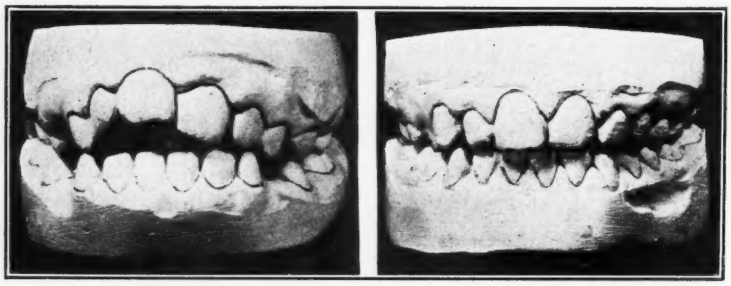


Fig. 21.—Malocclusion due to thumb-sucking. Spontaneous correction after the habit had been discontinued. (Collection of Grünberg.)

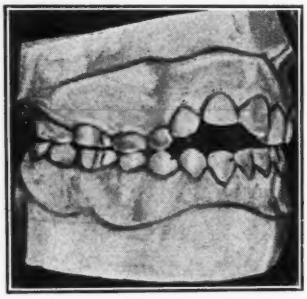


Fig. 22.—Malocclusion due to thumb-sucking. (E. Herbst.)

suggest in every instance postponing active treatment until we are sufficiently convinced that spontaneous correction by nature will not take place.

In Fig. 23 we see four stages of a case of Class II malocclusion that was treated by Grünberg with his method of solid ("en bloc") anchorage in maxilla and mandible and intermaxillary rubber bands (Fig. 23, II). Shortly after the removal of the retention appliance, after complete eruption of the second molars, a slight disturbance of the mesiodistal relations of the jaws and marked lingual inclination of the maxillary and mandibular anterior teeth was observed with deep overbite (Fig. 23, III). The etiology of this relapse could not at first be ascertained. Treatment was started again and finally led to the result shown in Fig. 23, IV.

Detailed questioning of patient and parents as to any special habits did not give any satisfactory results, although such a habit was suspected. Finally

one day Grünberg surprised the patient in a waiting room in the position illustrated in Fig. 24; further inquiry revealed that this position was a favorite posture of the child in reading and during leisure time, but it had not been considered of any significance by the parents. In spite of the cooperation on the

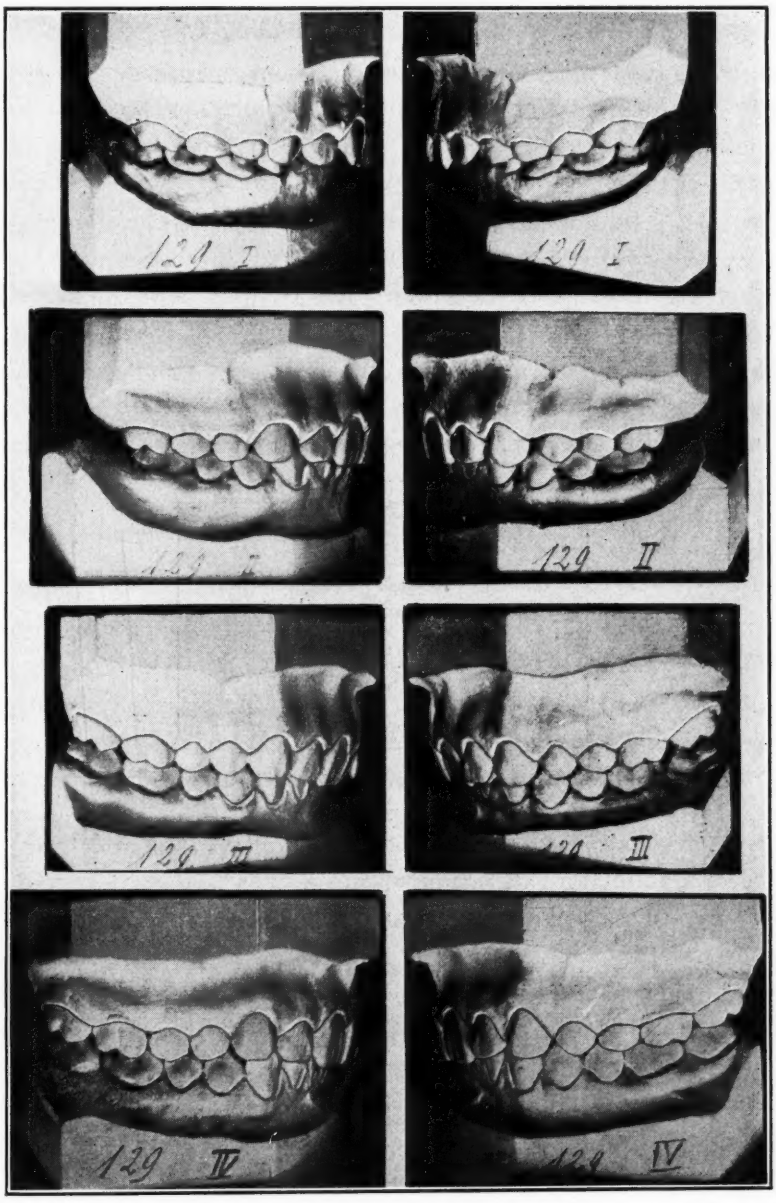


Fig. 23.—For description, see text.

part of the child, only by constant observation and admonition was it possible to break this habit which like all habits was done unconsciously, and thus avoid another relapse. I have published this case from Grünberg's very extensive collection in order to call attention to such etiologic habits which are generally not recognized as dangerous.

A very frequent habit which leads to characteristic anomalies and which will be illustrated in the monograph is biting the finger nails. Here also it is necessary to make the child conscious of this almost automatic and unconscious movement.

According to the observations of Hellmann,[17] failure to correct stuttering seems to favor relapses in cases of Class II, division 1.

The fight against mouth-breathing, which often persists as a habit after the primary cause (adenoids, deviation of septum, narrow jaws) has been removed, must be carried out with the full cooperation of the child and with his concentrated attention, but *by no means at night*, with the use of bandages or adhesive tape. In the latter case, besides involving the danger of nervous disturbances, the result is usually negative. In case of mouth-breathing of long standing, the muscles of the nostrils are atrophic and the nostrils collapse in every forced inhalation, which, of course, increases the hunger for air and frequently scares the child out of sleep. The correct procedure is to force nose breathing by systematic training while the child is awake and cooperating. The mouth should be kept closed and respiration should take place through

Fig. 24.—Habit of patient, the models of which are shown in Fig. 23.

the nose in order to strengthen the muscles of the nostrils and to prevent their collapse. The amount and duration of these exercises is increased every day until finally gymnastics can also be carried out with closed mouth and without causing dyspnea. This is the only systematic method for correcting mouth-breathing. Experienced pediatricians support the correctness of this opinion. Hofbauer reports, "The importance of this disturbance (mouth-breathing) is frequently underestimated, because most patients in breathing through the mouth do not keep the mouth open all the time or wide open, but leave only a narrow space between the lips whereby the teeth are in close contact. This restricted opening of the mouth, which is done for esthetic reasons, is usually replaced at night by a much wider opening of the mouth. Snoring frequently results or the child complains in the morning of dryness of the mouth and throat. In order to combat this extremely common form of mouth-breathing it is by no means sufficient to tie the mandible to the maxilla, as this has already been tried, or to close the mouth with bandages. *It is absolutely necessary to apply systematic therapeutic exercises* by which the patients are taught not only to keep the mouth closed during the short time when they wear these appliances but to keep the lips closed all the time."

The exercises of Rogers are frequently of inestimable value for the retention period. Strang[12] describes six of the most common appliances for retention and states: "One or more of these six retaining devices or slight variations of them are all that would be required to mechanically restrain the teeth until the natural forces had been harmonized to act as permanent tooth retainers, *provided, of course, that the dental units had been placed by correct treatment, in their proper relationship with the line of occlusion.*" In addition to what was brought out in the last part of this statement, Strang lays special emphasis upon the use of muscular exercises (Rogers) and devotes a chapter (Chapter XXVIII) to this important subject.

We shall always have to expect a certain percentage of failures, because many etiologic factors are still unknown, and therefore, many patients cannot be treated according to the principle that, the cause having been removed, the symptoms will subside. For some cases we shall need a permanent retention in the form of bridges or plates, namely, in those in which teeth are congenitally missing, and in malocclusion caused by pyorrhea. The general conditions of health and nutritional conditions, of course, play a great rôle.

Fig. 25.—Retention of the widening in the anterior region of the jaw for the purpose of spontaneous alignment rotation of the incisors.

The time required for retention must generally be longer than that for active treatment. This, however, depends largely upon the age of the patient: the younger the patient, the less time will be necessary for retention, because the processes of bone transformation occur more rapidly and extensively during the formative period.

Numerous observations of the past years have shown that rotated anterior teeth spontaneously assume the correct position if ample space has been created by the expansion of the arches and if the lips and the tongue are allowed to influence the teeth fully. Thus, in many instances, active orthodontic rotation and necessity for retention can be avoided. A wire which runs across the midline between the canines or the premolars and which allows for some movement of the anchor teeth (Fig. 25) will hold the teeth in a position in which sufficient space is allowed for the correct alignment of the incisors. This wire must run on the labial or lingual side close to the gum line in order to leave the teeth entirely free and to allow for full action of the lips and tongue upon them. Such cases will be shown in the monograph.*

Sufficient space for rotation and correct alignment of the incisors can be created not only by transverse widening of the jaw but also by an anteroposterior elongation of the jaws. In anticipation of the chapter, "Treatment

*See footnote, p. 1202, INTERNAT. J. ORTH., December, 1933.

of Class II Malocclusions," I am showing a clinical case in Fig. 26, in which the necessary distal movement of the entire maxillary arch was carried out by

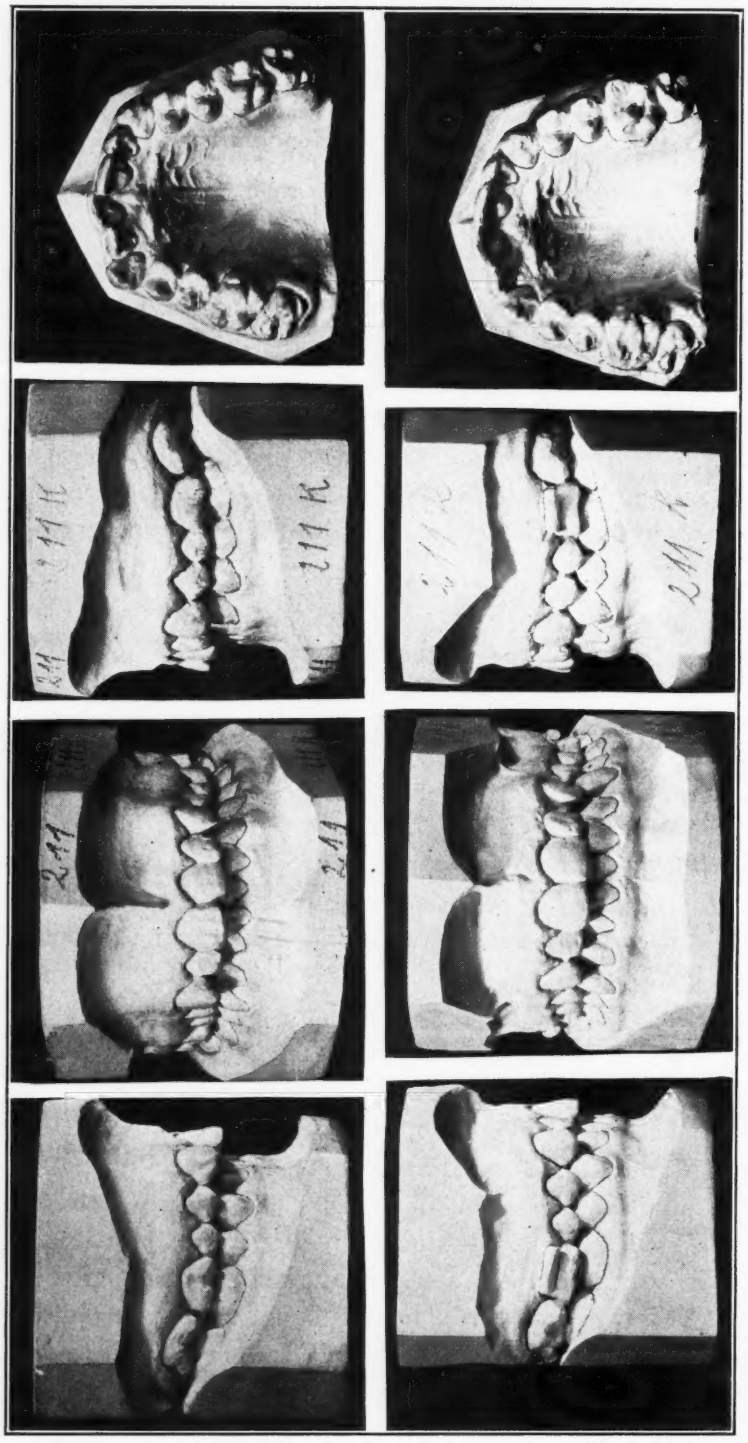


Fig. 26.—For description, see text.

the exclusive use of a head cap and traction bar which was worn only at night. The appliance within the mouth consisted of two molar bands on the maxillary first molars and a rigid high labial arch. No appliance at all was

used in the mandible. The result of two years' treatment is shown in the lower row of Fig. 26.

This case illustrates how space can be gained through a distal movement of all posterior teeth, thus causing an elongation of the jaw. This was followed by a spontaneous rotation and correct alignment of all anterior teeth. (Compare the occlusal views in the upper and lower rows of Fig. 26.)

If an active rotation is performed, it should always be exaggerated, and the teeth should be retained in this overcorrected position. A rotation to exactly the desired position will usually, within a short time after removal of the retention appliance, lead to a recurrence (Fig. 27).

Fig. 28 (Strang,[12] Fig. 477, 478) shows the correct exaggerated rotation and retention in this position. Such a retention with a band and two spurs (Fig. 28 *a*) is imperative if the rotation had been carried out around the central axis of the tooth. If a lingual arch is used, this arch is embraced by a spur which retains the overcorrected position (Fig. 28 *b*). If one end of the incisal edge of the tooth was in correct position in the arch, then a band with only one spur on the deviated side of the tooth is sufficient; if a lingual arch is used, one spur from this arch may be used to hold the one side of the tooth in its corrected position.

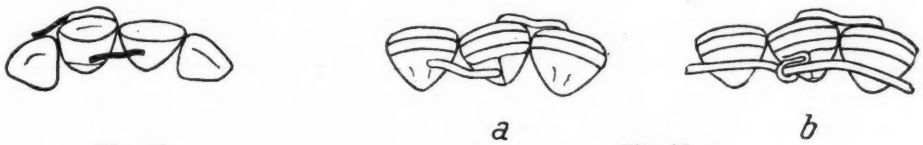


Fig. 27. Fig. 28.

Fig. 27.—Retention of a rotation incorrectly carried out.
Fig. 28.—Retention of a rotation correctly carried out. (Strang.)

Another of my postulates for avoiding the recurrence of crowding of mandibular anterior teeth is to leave in place the retaining appliance for the canines until the second molars have completely erupted. Even after this time, the retention appliance should again be placed if the eruption of the third molars causes the least change in the position of the anterior teeth.

This occurrence of crowded position of the mandibular anterior teeth is not necessarily due to a difficult or abnormal eruption of the third molars. The normal eruptive force of the third molars is able to bring about pronounced crowding in the area of the premolars and anterior teeth without there being any direct clinical symptoms on the part of the third molars. This has been emphasized by many authors, particularly by Dewey.[18] A control of the patient up to the time of completed eruption of the mandibular third molars is therefore necessary, unless the orthodontist wishes to run the chance of seeing his results destroyed.

Hellman[19] has made some fundamental contributions to the problem of the supposed change of development of the jaws as a result of our orthodontic measures. In addition to his publications Hellman has given me some personal communications which I shall mention with his permission in connection with his work.

By means of convincing diagrams based upon extensive examinations, Hellman has shown that orthodontic measures cannot in any way influence the natural growth, and that "appliances may at times not only be of no help, but even be a definite hindrance to natural processes of growth."

The dimensions of the human face are width, height, and depth. Of these the increase in width during growth is smallest, that in depth greatest. But this growth is not uniform in various levels of the same plane. For instance, the increase in length is greater in the posterior portion of the skull than in the anterior portion; the increase in width and depth is greater in the lower portions than in the upper. Growth does not take place simultaneously in all dimensions but alternately: if growth is more accentuated in one direction, it is retarded in another. If there are disturbances of growth, this alternating acceleration and retardation in the development of certain parts of the skull may become very pronounced. Thus it is possible that the upper part of the face may grow much faster than the lower part or vice versa, or this different rate of growth may be confined to one side of the face. These differences in growth are more pronounced in the male sex than in the female. The investigations and findings of Hellman are more valuable in that they were made on the same individuals for periods of from two to seven years.

In his paper "Diagnosis and Treatment of Class II" Hellman[20] shows that the growth and development of the individual are in an inverse proportion to the development of the dentition: in fast growing children the teeth erupt more slowly and the shedding of the deciduous teeth takes place later; on the other hand, in slow growing children the teeth sometimes erupt very fast, even before the jaws have had time for full development. Both conditions cause a lack of harmony of maxillary and mandibular jaws, frequently unilateral, and these incongruities no doubt frequently cause anomalies of occlusion. "It should also help convince one of the fact that natural growth takes place on account of influences from growth-promoting factors, of which we know nothing, and not because of the use of mechanical appliances only. . . . It must, therefore, be concluded that since the diagnostic features of malocclusion of the teeth are inseparably connected with the natural process of development, and since orthodontic treatment consists of artificial force exerted by mechanical devices upon living structures, it is necessary to be wary of the fact that the procedure must be made to conform to those conditions which constitute natural limitations to general growth phenomena."

With these sentences in which Hellman summarizes the results of his investigations, he must necessarily restrain from excessive optimism. In his next publications he will show that relapses of treated cases are frequently not due to improper treatment but that peculiarities of bone growth in the skull and in the jaw are much more responsible than we have heretofore been able to demonstrate.

Because of the frequent relapses Skogsborg[9] recommended and still recommends the septotomy which consists of cutting through the soft tissues and bone between the teeth in order to relieve the assumed tension in the tissues. With this procedure, which is based upon Walkhoff's theory of tension of the bone

tissue after the regulation of teeth, definite success of individual tooth movements and probably also of expansion (through septotomy between the premolars and molars) should be obtained.

These opinions of Skogsborg are in turn supported by Walkhoff[8] and have also been introduced in Simon's[21] textbook (page 276), "In rare and special cases surgery may be indicated (Skogsborg operation)"; (page 280) "as a last help if there is a repeated relapse following the rotation of anterior teeth, surgical methods as described by Skogsborg are indicated."

Let us review the reports with which Skogsborg supports and justifies the value of this method. The first publications appeared in 1926[9a] and covered nine cases with the time of observation of from seven to twenty-seven months

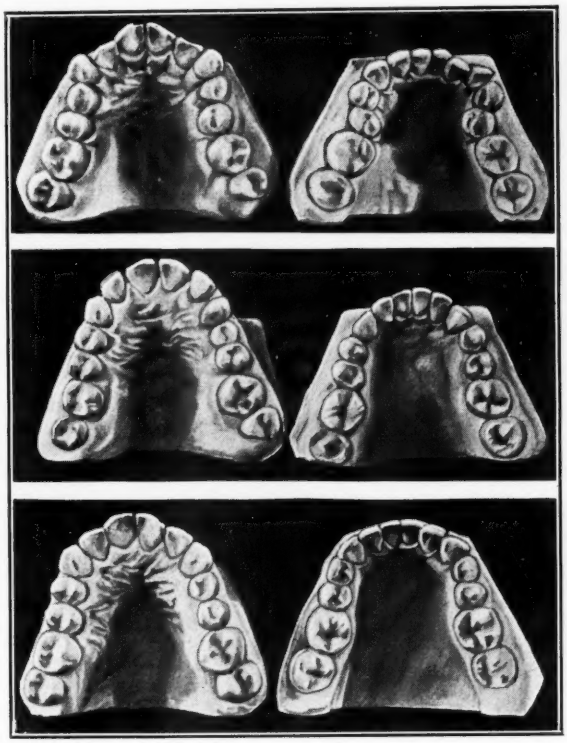


Fig. 29.—Case of Skogsborg's. Relapse in $\frac{5421 \mid 145}{32 \mid}$ despite septotomy. (Drawing made from original.

following the operation. Skogsborg states, "a period of four to six months is sufficient for a complete regeneration of the bone tissue in the septa, thus forming a safe support for the teeth in their new position." Skogsborg comes to the conclusion that a suitable method of achieving the final goal of permanent retention of teeth has been found.

However, his results speak very much against this conclusion. Of the cases shown in his publication, there is a beginning or definite relapse visible in two cases (Nos. 4 and 6) after twelve months, in one case (No. 8) after ten months, and in one (No. 10) after eleven months. Thus, despite mechanical retention *plus* the operation, there has been a relapse in four out of nine, or in other words, in 44 per cent of his cases.

After six years of additional experience Skogsborg published the results of nine additional cases[9b] and states: "Septotomy, however, resulted in all (cases) remaining unaltered after the completion of the dental regulation and a relatively short period of mechanical retention." Fig. 29 shows Case 8 of Skogsborg with relapse in $\frac{5421\,|\,1\;45}{32\;\;|}$ three years after the operation (Fig. 29 *C*). In the maxilla operations (eleven altogether) have been performed on all septums; in the mandible eight septums have been operated on. In the area of the premolars he admits a slight relapse despite retention with a plate. Three years after the operation both the central incisors began to assume the protruding and rotated position (Fig. 29 *C*) which had been corrected at the end of the active treatment (Fig. 29 *B*). The right maxillary lateral incisor has again rotated lingually with its mesial edge, thus assuming almost the

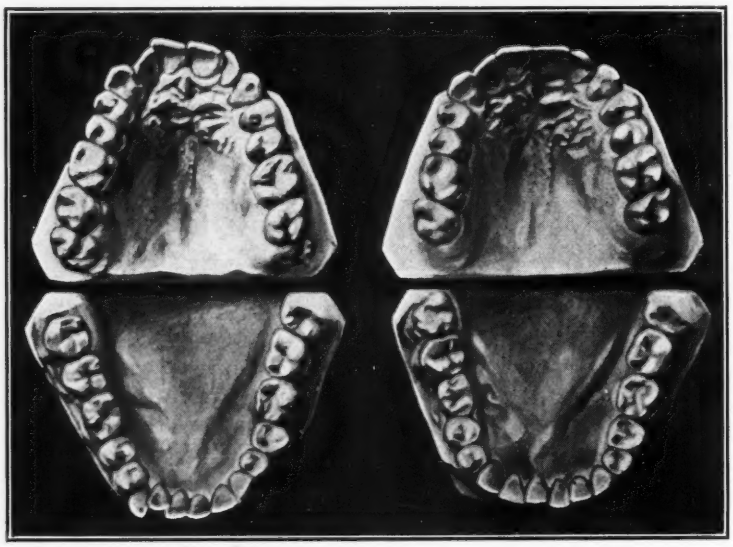


Fig. 30.—Case of Gray's. Movement of individual teeth $\frac{(\;21\;|\;12\;).}{2\;\;|}$ No relapse after four years of observation, without septotomy. (Drawing made from original.)

same angle with the central incisor as in the beginning of the operation. A similar return to the old position is found altogether in nine teeth despite nineteen septum operations.

Relapses are also found in Skogsborg's Case 5, in the maxillary right central incisor; in Case 6, in $\frac{\;\;|\,1}{21\,|\,12}$; in Case 7, in $\frac{\;\;|\,1}{2\;\;|\;\;2}$; in Case 9, in $\frac{21\,|\;\;}{2\;\;|\;\;2}$. In all of these teeth septotomies had been performed, frequently on both sides of the same tooth.

While in the first cases of Skogsborg with two years' observation (publication of 1926) 44 per cent had relapses, this number increased after three or four years of observation to 50 per cent (publication of 1932). Since the number of relapses shown in Skogsborg's second publication amounts to 50 per cent after three or four years, it is necessary to assume that the damage done by the operation can be held responsible for the great percentage of relapses.

In selecting at random any one of the cases of permanent results that are published in dental literature, I should like to show a case reported by Gray[13] (Fig. 30) in which no relapse took place despite the fact that a considerable part of the treatment consisted of rotations. By means of correct treatment and retention the favorable condition was maintained without any surgical interference for four years after all appliances had been removed.

The surgical method of retention with which Skogsborg had 50 per cent relapses has recently been recommended by Schwarz,[22] who states in his publication in 1932: "The tendency of alveolar tissues to regenerate in connection with orthodontic movements is an essential biologic factor in the production of relapses. Septotomy (Skogsborg) and gingivotomy are biologically well founded as preventive measures against relapses."

One year before, Schwarz[23] had studied his doubts about the advisability of gingivotomy "because the contracting scar represents an additional complication."

In addition to the fact that Skogsborg's septotomy by no means guarantees the retention of the obtained result, it is a method which causes the patient great discomfort, pain, and even danger (possibility of osteomyelitis) and which involves the danger of injury to the roots, as suggested by Skogsborg himself: "Before performing septotomy it is highly important that x-ray pictures should be taken of the areas concerned, as it frequently happens that the roots of certain teeth converge toward the apices or that the interdental septums are extremely thin. There is then risk of more or less extensive injury to the roots. Here lies, of course, a certain limitation to the method and its employment, and a contraindication of this kind must be carefully watched."

Schwarz's attempts to defend Skogsborg's operation are based merely upon argumentation and upon drawings by which he attempts to illustrate certain differences in the tissues on the different sides of the tooth in orthodontic movement. Therefore, I cannot assume any other position in this question except a definite refusal of Skogsborg's procedure and shall only repeat what I said several years ago,[24] "If Skogsborg were able to retain Class II or III cases or open-bite cases with his method, his suggestion would deserve a thorough clinical and experimental test. The retention of individual teeth, however, by no means warrants such a radical procedure."

REFERENCES

17. Hellman, M.: Cusps and Occlusion, Dental Cosmos **75**: 240, 1933.
18. Dewey, Martin: The Third Molars in Relation to Malocclusion, INTERNAT. J. ORTHO. **3**: 529, 1917.
19. Hellman, M.: An Introduction to Growth of the Human Face From Infancy to Adulthood, INTERNAT. J. ORTHO. **18**: 777, 1932.
20. Idem: What About Diagnosis and Treatment of Class II Malocclusion of the Teeth? INTERNAT. J. ORTHO. **17**: 113, 1931.
21. Simon, P.: System einer Biologisch-mechanischen Therapie der Gebissanomalien, Berlin, 1933, Hermann Meusser.
22. Schwarz, A. M.: Gewebsveränderungen bei orthodontischen Massnahmen, Fortschr. d. Orthodontik, No. 2, 1932.
23. Idem: Der heutige Stand der Orthodontie hinsichtlich Prophylaxe und Frübehandlung, in Scheff's Handbuch d. Zahnheilkunde **6**: 295, 1931.
24. Oppenheim, A., and Grünberg, J.: Orthodontische Therapie, Fortschr. d. Zahnheilk. **4**: 827, 1928.

THE POSSIBILITIES OF, AND DIFFICULTIES ASSOCIATED WITH, FIXED APPLIANCE WORK*

H. C. Visick, L.D.S., Eastbourne, England

TO DISARM criticism I am going to apologize for the fact that my share of this paper hardly justifies the title. That is because the title was chosen first; and when I proceeded to write, I realized that I could not possibly do more than mention a few of the uses I had found in general practice for fixed appliances, and some of the difficulties I felt I had overcome.

I was one of those privileged who had an opportunity recently of seeing the work of some of the orthodontic specialists in Canada. What I saw impressed me with the fact that we in this country are greatly handicapped by the domestic and scholastic conditions over here. But perhaps the chief difficulty is that we are not "tooth-minded," to use an ugly but expressive word. I will give one example. I saw in the office of one of Toronto's orthodontists a girl of about twelve years of age. It did not seem to me at all a serious case of malocclusion, but there she was with a band on every single tooth in her head, maxillary and mandibular—twenty-four in all! I asked the operator how long he reckoned it took him to put on the apparatus before he started treatment. His reply was, "About twenty hours' work in the mouth"! It would greatly interest me to hear any man try to convince an English schoolmistress of the need for such lengthy treatment. In face of cases like that, one is a mere dabbler in orthodontics.

I have approached my subject rather from the point of view of the general practitioner who wonders whether he is wise in attempting to make use of fixed apparatus.

A great deal has lately been said about the technical difficulties of this work and its dangers to the teeth and soft tissues, and it may be that some of the more timid and conservative members are hesitating and wondering if they ought to leave fixed apparatus to the specialist alone, and confine themselves to more simple appliances. Now I want to say at once that by so doing they will deprive their patients of certain benefits and services, which in these days they may well look for from the general practitioner; and also they will most certainly miss one of the greatest joys in life, and that is in the sense of achievement which comes with any success, however small. Fixed appliances are being used more and more, and it is a poor thing if a dentist is so behind the times that he is unable even to repair or adjust such an appliance for a patient who may be visiting in his town.

Now as to the "possibilities." There are almost illimitable fields of use for the specialist, and I feel it would be presumption on my part even to attempt to describe them. But I would rather point out the possibilities of these

*Transactions of British Society for the Study of Orthodontics, 1932.

fixed appliances for the general practitioner, and mention some of the simpler cases which can be better, and possibly only, treated with fixed apparatus.

Class II, division 1 cases, treated by extraction, are preeminently suited for correction with a fixed appliance. A plain arch sliding in buccal tubes on molar bands, with elastics for the motive power, will work smoothly and surely, and with little attention. Most important of all, the front teeth can be retracted without any forward movement of the back teeth. I do not think this claim can be made for any removable appliance, and it is sometimes of vital importance that the whole of the space obtained by an extraction shall be reserved for the front teeth. I shall explain later on the essential details to ensure this result.

Rotation of the incisors is possible with plates, but how much simpler this operation is with fixed apparatus, and what can be done with canines, premolars and molars unless we use fixed appliances?

JUMPING THE BITE

I know some workers manage to treat postnormal occlusion cases with removable appliances, but they have not been successful in my hands. I believe the great majority of these cases can only be treated successfully with intermaxillary traction.

DIFFICULTIES

Turning now to the difficulties, I have tried first of all to remember all those which I have had worry me in the past, and which I feel I have solved or at any rate partly conquered, and I am going to tell you just what I believe is the best thing to do. The chief difficulties are due to the fragile nature of these appliances, and the fact that they are easily broken or bent out of shape.

I really believe that if you can persuade your patients to give up eating toffee you will have got a long way in avoiding breakages. When a fixed appliance breaks, it usually means an immediate visit to the dentist, or failing that, a frantic attempt on the part of the patient or parents to remove the remaining part of the apparatus. This removal is usually accomplished at the expense of further damage to the apparatus, waste of time and a setback to the course of treatment. I shall take these breakages in the following order: bands, body wires, spring wires.

Before proceeding to enumerate the pitfalls to be avoided, I want to say a few words on the necessity of proper tools in the fitting of bands. If any one decides to try fixed appliances, I consider he would be wasting his time, and be quite unable to obtain the best results, unless he makes use of a few simple but invaluable tools which are made especially for orthodontists. I stress this because without them the dentist is at a disadvantage, and is almost certain to get unsatisfactory results, which may discourage him and possibly give him an entirely wrong idea of the possibilities of these appliances.

TOOLS

There are two absolutely essential tools:

(1) Mershon's band pusher.

Do not say you have an old gold plugger which does "just as well," because if you do I shall be quite sure you have never used a real band pusher. The amount of force which it is necessary at times to exert on a band far exceeds that ever used in gold plugging. The serrations on a gold plugger are quite unsuited for the edge of a band. So if you decide to put on a band, you must make up your mind to buy a proper pusher.

(2) The next absolutely essential tool is a band remover (Case's pattern). Do not imagine you can save anything by doing without one. You can't! During the fitting of a band it will be necessary to remove it half a dozen times at least, and a band remover does it in a moment. Once the band is cemented the only practicable way to remove it, without mutilation, is by a proper band-removing plier.

These two I consider cannot be dispensed with, but there are others which save time and give better results. I shall just mention a few:

(1) Band-making pliers (Angle's).

(2) Band-stretching pliers enable one to make use of a band which otherwise must be discarded as too small.

(3) Contouring pliers.

(4) Tungsten soldering tweezers (Julius Aderer's).

These are the most satisfying tools I have ever come across. They never bend or break or corrode. No solder ever sticks to them. They are a joy to use.

ANCHOR BANDS

Now about the bands. A band may become loose or it may break. The commonest cause of either is the use of unsuitable material in composition or strength. *In my opinion the use of German silver for molar bands is a sheer waste of time.* It lacks the strength and stiffness essential in a molar band where the forces of mastication are at their greatest. If you believe the call for economy makes the use of precious metals impossible, then don't attempt the case unless it is one where the child is close at hand in the event of a breakage, or where the case is a simple one which will take only a few months.

BAND MATERIALS

What materials should be used? Gold platinum alloys, such as Dee's band material, gauge 0.006 and 0.180 width, or possibly 0.200 for molar bands. Whatever you do, don't be beguiled into using anything thinner. The thinner gauge is easier to fit—but it is the easy road that leads to destruction! A little extra time taken in fitting the stiffer material will be well repaid later on.

In making a band it is much better to have it too large than too small. If the band on a molar encroaches on the masticating surface and gets bitten up by the opposing teeth, it is bound to stretch and loosen. This most frequently happens on the mandibular teeth and is the result of the band being too high up on the buccal surface. If the band is too small when first soldered, it may be stretched by suitable pliers, but do not carry this too far. A stretched band is a thinner band, and may lead to trouble. It is far better to have a band which is a loose fit than one which does not go quite far enough. The cement

will fill in the space. Next, be sure the rim of the band fits the tooth snugly at the masticating surface. To shrink the top edge of the band is quite simple if one nibbles along the edge with a smooth-beaked plier (such as Peeso's crown and bridge pliers), bending the edge inward and working round and round until the desired amount of shrinkage has been obtained. If necessary cut the edge of the band and overlap the cut surface and solder together.

Cementing.—A real good hard cement (such as Ames' crown and bridge) must be used, and most important of all, the tooth must be clean. I find the use of taxi most satisfactory. It leaves a beautifully clean surface free from all deposits, on to which the cement sticks like glue.

To repeat, for a satisfactory anchor band you must have:

(1) A thick, stiff material.
(2) A large enough band.
(3) A snug fit on masticating edge.
(4) A clean tooth surface.

Do bands ever hurt the enamel? Yes, they can do so, but only in cases of neglect. It is many years since I had anything of that sort happen, and the way to avoid it is simple. Always examine the bands critically with a fine probe, and see whether there is any sign of the cement washing out at the edge. If so you may be pretty sure there is loosening going on, and you should get your band removers and have it off. A good general rule is never to let a molar band stay on more than nine months. Incisor bands, six months at the outside. Then, however firm they seem to be, remove and recement. I remember seeing only once any decalcification caused by an arch. That was in a case where the patient, a girl who was particularly careless about her teeth, went away with a lot of ligatures on the incisors, and I did not see her for nearly six months. There was a white decalcification above the labial arch on all the incisors. After five years they have not decayed, but are unsightly.

BODY WIRES

The arch itself is liable to break, and when this happens the commonest place is close to the attachment. I believe this is caused by the patient's getting the tip of the tongue under the front of the arch and playing with it. To prevent this a band should be placed on at least one of the six mandibular teeth with a spur on the lingual side under which the arch can be locked into place, and so prevent the tongue's lifting it up.

FINGER SPRINGS

The next most usual difficulty is the displacement or bending of the finger springs. It is no use sending a child away to school with complicated finger springs unless you know there is a dentist who can attend to the appliance at the school. Only the simpler forms of appliance can be used with confidence that treatment will go on uninterruptedly. These delicate wires must be adequately protected from the strain of mastication by being placed beneath the body wire, and the free ends prevented from coming up by small wires soldered to the arch at right angles, called spring stops. The weakest part of a finger

spring is at the soldered end where it has been heated, and it is just there that the strain comes. To avoid fractures at this point, I find the most satisfactory way is to solder, and then make two complete turns round the arch before taking the finger spring wire to the point of action. This greatly reduces the strain on the soldered joint and adds enormously to the springiness.

RETRACTION ARCH

I think the simplest and most common use for a fixed appliance is in the retraction of the maxillary incisors and canines in cases where the first premolars have been extracted. Nothing in my experience works so smoothly and surely, and with so little need for attention, so that a child can be sent away to school with the confidence that, barring accidents, the treatment will be continuous during the term time. It is this absence from the dentist that makes me emphasize the importance of using bands which will not come off. If the patient is going to be closely under your care, a broken band means only the annoyance of replacing it, but away at school a breakage may mean several months of treatment lost. You are all familiar with this application of the plain retraction arch with elastics for the motive power. I want, however, to stress certain points which are sometimes overlooked.

First of all, the pull on the posterior teeth will cause them to tip forward and encroach on the space obtained by the extractions, unless we very definitely take steps to prevent it. This is simplicity itself. You must proceed just as though you were trying to tip the molars backward. First of all, solder clips on the arch which will rest on the incisal edges of the central incisors. Bend the arch so that when it is at rest it lies at the neck of the incisors. Then spring it down and let the clips rest on the incisal edges of the central incisors. The apparatus, left to itself, will now tilt the molars backward. But when we put on the elastics, their forward pull tends to counteract this movement.

The only possible movement now for the molar anchor tooth is bodily through the jaw, which as you know is almost impossible, so that we have a practically immovable anchorage, and all the front teeth can be moved back with the molars still in their original position. It is quite possible actually to tilt the molars distally while using them to pull the incisors back. So stable is this form of anchorage that if by any chance the first permanent molars have been lost, one can use the second premolars for retracting all the maxillary teeth without these comparatively weak teeth coming forward.

Resting these incisal clips on the central incisors has a distinct advantage. These teeth are quite frequently too long, and the pressure from the arch is sufficient to push them up into the socket; so much so that I frequently find it necessary to put spurs on the lateral incisors as well, to prevent the central incisors going up too far.

LIGATURES

If ligatures are necessary, I use the thickest wire possible and take the precaution of twisting the free ends completely round the arch. The important thing is to secure the ligature so that the toothbrush cannot loosen it.

I never now use ligatures for a patient who is going away to school—unless I know there is a dentist at hand to attend regularly to the case. I think that as time goes on I am becoming more cautious, and do not attempt any but the simplest cases unless they are under my eye all the time. I have learned from very annoying experiences that a broken appliance away at school can cause more trouble than it is worth.

THE POSSIBILITIES OF, AND DIFFICULTIES ASSOCIATED WITH, FIXED APPLIANCE WORK*

NORMAN GRAY, L.D.S., H.D.D., EASTBOURNE, ENGLAND

WHEN Dr. Visick and I were asked to write this joint paper, it was decided that I should try to point out some of the possibilities and difficulties which affect the patients rather than their appliances; and so quite naturally it is my lot to speak more of problems and difficulties than possibilities. In the main, I propose to leave the possibilities of the fixed appliance to the judgment of my hearers.

Fixed appliances are legion. My experience allows me to speak of only the simple Mershon technic and not of the multiple banded apparatus (which is fixed in the real sense of the word). Among the obvious possibilities let me briefly remind you again of the seemingly unlimited movements one can obtain with the variations of these simple arches, of the delicate pressures continued long after the adjustment, and that visits for adjustment can be relatively infrequent. Appliances of this type make it possible for the patient to be away for long holiday periods or for the whole school term. We know that these gradual movements tend to be more permanent, and that retention is thereby frequently avoided.

So much for possibilities. In life the problems usually come before we get through to the possibilities, and so one feels that a paper about difficulties will be more practical. One of the first difficulties is to explain the possibilities of the fixed appliance to parents or guardians of the prospective patient. Children often come with pain and the orthodontic problem may not have been noticed. So frequently do adults exclaim at defects overlooked in childhood that I always make an effort to get in touch with parents or guardians in order to point out the abnormalities and the problems it may cause in adult life if overlooked. Very often the parents are abroad, but if for one reason or another I have been unable to see them, I follow the matter up with a short letter when the accounts go out. I briefly outline the matter of the account and then mention the orthodontic problem in case it has been genuinely overlooked. It saves me being shouldered with the responsibility of neglect, and it shows my interest in the child. If further correspondence ensues, I ask for one of the parents or a trusted relative to come to talk the matter over with me, as this saves the misunderstanding of letter writing. I find it much easier to explain the possibilities of treatment by comparison with models of past cases similar to the case in hand, by diagrams, and by models of actual appliances. If the patient is the mouth-breathing type, I have a collection of full face and profile photographs of old cases before and after treatment. When once a parent can see

*Transactions of British Society for the Study of Orthodontics, 1932.

and handle the problem under discussion, and has the opportunity for comparison with similar cases, the difficulties and possibilities are more readily grasped than when merely talked about or written about, and ever afterward they cooperate more satisfactorily. Words are such empty things to play with, and the mental picture of the parent is often amazingly different from ours if we could but know it. Of course this method applies to all forms of orthodontic treatment, but the fixed appliance is particularly difficult to explain without models. If you have collected a demonstration museum of this sort, you have gone a long way toward solving the first problem, and the visit gives an opportunity to discuss the elementary principles of growth and development, together with nutrition, oral health and hygiene, as well as the subjects Dr. Martin Dewey grouped together and aptly called "Preventive Orthodontics."

So far so good. The next problem more peculiar to fixed appliances is the nervous small child. Not the *very* young child with only deciduous teeth present (I doubt if any orthodontic appliance is advisable for such very tender years), but a child of seven or eight years. One can take a compound impression readily enough and insert a plate which the child will wear quite cheerfully, but the fixed appliance is a much more difficult affair. In such cases I find it eminently helpful to make a special point of the child rather than the parents. I address myself exclusively to the child and never attempt any form of treatment until I have induced my patient to take an intelligent interest. Again I find it extremely helpful and interesting to the child if one shows models of old cases before and after treatment, helped with suitable photographs, and fear goes as interest comes. Talking to the child I find the parents are interested too. As a starting point I usually make a chart of the mouth and talk about maps and geography, and point out some of their own prominences and landmarks. Sometimes I make a few measurements with calipers; another time I ask my partner to photograph them in the drawing-room. They did not expect that at the dentist's! I can then point out that whereas the drill *was* a bit beastly and stung, making bands and arches, etc., will never hurt. It will only be like making wedding rings, and would they like to come to the surgery bench and watch me make them? I have not yet met a case in which one could not ultimately overcome the child's fears and make the little patient genuinely interested.

If the first appointment is spent in collecting data of the case, it is not wasted time, and the next visit usually produces a little patient brimming over with self-importance and keenness. Plaster impressions are usually the first step, and a somewhat messy and choky business can be rather fun if the child cooperates. I have plaster models of lips and noses and funny faces. I let them watch with a looking-glass and afterward we fit some of the jigsaw pieces together. The majority of children ought to leave the surgery quite sure that the treatment does not hurt and that it is not bad fun.

Similarly with the next stage, the fitting of bands, a nervous child will be tremendously relieved if a few of its endless "whys" are satisfactorily answered. An explanation is given to help the child cooperate—one must judge whether the child is merely doing it to waste time.

As much as possible avoid heavy pressures by use of separating wires, by allowing bands to remain in situ for some minutes, by cooperation of the child

in biting the band down with orangewood sticks. Even so one runs up against badly shaped teeth, bad fillings and advanced caries. These points together with the temporary impaction of the second molar are touched upon by Dr. Visick in his paper.

Another problem peculiar to fixed appliances is the school appointments. In the early stages half a dozen long appointments are required, and I find it best to state this frankly to the school, asking for special concessions as regards times. Quite rightly one needs to be fresh for this work, and have the best part of the day for it, so the appointment book must be kept clear for the purpose. One can readily promise that subsequent visits will be relatively infrequent and easily adjusted to set time-tables.

Another series of difficulties is the problem of the broken appliances, upsetting to the patient, the school and the dentist. The removable appliance can often be sent satisfactorily by mail for repair, but not a fixed appliance. Sometimes it is entirely the fault of the patient, but quite as often the fault of the dentist. It is very important to know which is to blame lest one discourage or frighten young children. I never charge a fee for broken appliances on this account unless broken or lost through gross carelessness.

Causes of appliances breaking:

Caramels.
Overheating.
Finger springs.
Age of appliance.
Heavy bites.
Pain.
Medical intervention.
Careless and thoughtless patients.

Before the appliance is first inserted the patient is warned that the mouth will be a little uncomfortable for twenty-four hours, but that this will soon pass and should not trouble him again. Patient and parents are told that if anything ever breaks I am to be informed at once, and all parts are to be kept carefully; also that no parts must be removed save in exceptional cases. I ask them to promise me not to eat *caramels* and sticky sweets, and advise the parents to assist by sending hard boiled sweets as a counter-attraction. In the case of a labial arch in boys, I tell them if they do any boxing that it must be stopped for the present.

With regard to *overheating,* this is generally avoidable by careful laboratory technic.

Finger Springs.—These are a fruitful cause of trouble. Avoid them as much as possible. Many of the tooth movements may be obtained by the body wire itself. Kinks may be put into the arch which can be straightened out, and this will cause adequate pressure in most of the desired directions. Finger springs tend to lift the body wire up from the mandible and down in the maxilla; sooner or later this causes the breakage of the spring or of the body wire at the D-tube attachment. When a spring has to be fitted, it should be coiled round the body

wire two or three times after soldering. This improves the temper of the spring and protects the weakness of the soldered joint.

Age of Appliance.—With the precious metals the same appliance can be used for a very long time, so this must be safeguarded by the regular annealing of the arches, and the periodical inspection of the bands.

Medical Intervention.—This is an occasional difficulty during illness or prior to an anesthetic, but a very trying one. I have had finger springs cut off, arches forcibly torn out of the mouth. A warning can be given about this in a preliminary talk, and the instruction will vary with the type of appliance.

The careless and thoughtless boy or girl is my greatest difficulty. It is a great help if one can spot them beforehand as then one can ask that a large proportion of the fee be paid early in the proceedings. This is not greed, but definitely tends to make parents and school cooperate seriously. A simplification of the appliance is essential in these cases, and a serious talk should follow each misdemeanor. If after repeated efforts with alternative types of appliance the child remains incorrigible, it is better to wash one's hands of the case.

When the appliances have been inserted, I have found it a good plan to stress the renewed importance of the toothbrush and dental tape. It is better to do this when the child is alone; if the patient thinks it is done at the parent's instigation, he will not be overimpressed, but a pally "man-to-man" talk is very impressive. Similarly, as Sir Norman Bennett pointed out, it is very important to make the child responsible for the appliance rather than the parent. I do this in a number of ways. Intelligent children may be taught to remove labial arches for cleaning; they will readily appreciate how important it is that they should not get bent and why. If the new labial arch is impressed in a tablet of warm modeling compound, this will make a safe receptacle for the arch, and the interested child will notice any distortion immediately. If rubber elastics are used, the child writes direct for a further supply when he runs short, and these I send by mail to him personally with a note.

Please do not imagine from this paper that I claim complete success with all my cases, but I have found these methods help me to surmount most of my problems, and we all know the joyous sense of achievement if we can win the confidence of a child and teach him to help himself in a later day. I trust that my remarks will lead to a helpful discussion. If I can do this, the paper will have been worth while.

DISCUSSION

Mr. F. J. Downing, speaking on the question raised by Mr. Visick as to fixed appliances, said that he still preferred movable appliances, especially when retracting maxillary incisors after taking away the first premolars. He agreed with Mr. Visick as to the nuisance of toffee eating. Mr. Gray had mentioned that when a child was absolutely untrainable with appliances it was just as well to relinquish the case. Another member mentioned that he had not experienced trouble from the breaking of ligatures since using stainless steel ligature wire, which seemed to stand up to the requirements remarkably well.

Mr. Marsh said that he had been puzzling over the diagram shown by Mr. Visick on the blackboard, and he had so much respect for Mr. Visick that he felt sure that what he, Mr. Marsh, thought was the case, could not be right. But, as Mr. Visick had said, they all knew that if the appliance were used in the way Mr. Visick had drawn it, and

made the molars the anchorage by which to pull back the arch, these anchor teeth would move forward. Mr. Visick then bent the arch upward and brought it down by means of the catch at the tip of the incisor teeth, and so created a force which drove the occlusal part of the molar backward and enabled it to pull the arch backward without itself being pulled forward. It seemed to him that one force must counteract the other. Yet Mr. Visick stated that that was not so, and the anterior teeth were retracted. If that was the case, all of them to whom it was new had learned a very great deal. He had been for many years making use of intermaxillary traction, and using the tubes on the buccal surfaces of the mandibular molars for the elastics in these cases. Mr. Visick did not say anything about the fixed appliances which he used for rotation, and many of those present would like him to say something about them. He himself had found extremely useful the auxiliary spring attached to the labial arch—the spring and band as Dr. Jackson had shown at the International Orthodontic Congress.

Mrs. Possener Michaelis, following upon what a previous speaker had said about the child who was "washed out" from other practices, suggested that probably 99.9 per cent of the children who came as "impossible" patients had been made impossible by a dentist somewhere. She believed quite firmly that any child could be handled if he was handled correctly in the first instance. It was the first stage that was the most important. It was just a question of finding out what it was that had scared the child, and of wiping out the scare. The question of fees had been mentioned, rather tentatively, and she desired to ask whether, in treating an orthodontic case, the mouth as such should be treated, or whether one should treat the like condition as such. She herself favored a scheme which was designed to encourage people who were rather frightened of orthodontics. If she was treating a patient orthodontically she did any work which might be necessary during the period of treatment. If, for example, the treatment was going to last three years she did any work which might be necessary during that period without sending in an additional account. That was quite an interesting point for an orthodontist who was not a specialist.

Mr. J. H. Badcock, pointing to the instruments which Mr. Visick had exhibited, said that he was almost ashamed to admit that he himself had been able to fit his molar bands without any such tools. He had done so by using the finger and a piece of wood. He did not think that any one need be put off by the feeling that a number of special tools were required. With regard to the material of the bands, he agreed with Mr. Visick that precious metal should be used, but there again, if expense was a very material consideration, he thought one could do without it very largely. In that case he would advise the use of Blue Island band material, which was possibly a sort of German silver, but of a particularly soft kind and very easily molded to the shape of the teeth—more easily, really, than precious metal—as well as able to stand up for quite a reasonable length of time. With regard to the fitting of the bands, if one snipped the edges of the band it was very much easier to fit, but he went further in this respect than Mr. Visick had done. Mr. Visick made two or three nicks, whereas he made nicks all the way round—a sort of fringe—and with his despised gold plugger he pushed down one section after the other, only slight pressure being necessary, so that he did not have to push hard and frighten the child. He had been rather surprised to find that a number of people did not seem to know about the apparatus for extracting the maxillary front teeth that Mr. Visick had described. Nothing could be more efficient or foolproof, and he personally had used it for at least twenty years. He placed the utmost reliance in it. He used clips not only on the central incisors, but on the lateral incisors too, because there was always a tendency to shorten. He adjusted the appliance so that it just touched the teeth to begin with, and he found that those teeth began to shorten. Then he took the arch off and bent it slightly, and in that way he got exactly the amount of shortening desired according to the pressure put on. He put it on the four incisors so that they all shortened equally, and as one drew them back one pushed them up. Various speakers had mentioned the canines. His practice was to pull the canines back at the same time as the incisors, but he always gave them an extra pull because they were harder teeth to deal with. He

banded the canines separately and put a little hook on the canine band and used an added elastic. This he found very satisfactory. That brought him to another small point. He always cast the canine bands instead of making them in the ordinary way with band material. He took an impression in a copper ring with a little composition and cast that in cement. It made a perfect fit, giving no trouble, and sticking very well indeed. The whole thing worked automatically, and there was no worry about it, and practically no possibility of failure.

Mr. Catchpole said that he had been hoping Mr. Visick would have explained one further trouble which he himself seemed to experience. He found that when he had a lingual arch in the maxilla and mandible, the mandible often seemed to go to one side for some reason or other. He had been unable to decide why this bias occurred, but certainly the patient seemed to be biting to one side.

Mr. Robert Cutler said the subject was of perennial interest to them, because at heart the best orthodontists were essentially mechanicians, and the mechanical possibilities of fixed appliance work appeared endless. It had long been known that Mr. Visick and Mr. Gray were keen propagandists of this system. The Society had listened to their views with considerable interest, more particularly as many members were aware of the technical quality of Mr. Visick's work in other spheres, and they could not doubt the sincerity of the opinions the authors had brought forward. Possibly the authors were particularly fortunate in that their patients were so largely under their supervision and control while at school, so that the maintenance of these delicate fixed appliances was very easily effected. In London, those who practiced orthodontics were less fortunate in this respect, and often had to bring about their results by means of less elegant, but not less utilitarian appliances. It was a far cry from orthodontia to a discussion upon the teaching system in this country, but to his mind it was extraordinary how the average English parent, as he found his child growing to an age of rational intelligence, particularly susceptible to external ideas and environment, and most likely to benefit from parental experience, dispatched him forthwith to some teaching institution, as far away as possible, where he was molded into some standardized pattern, the virtues of which were sometimes a little difficult to discover. It was the price that had to be paid for the comforting reflection that so many famous battles had been won on the playing fields of certain schools. From a technical standpoint the case for fixed appliances could well be argued. For instance, Class II, division 2, cases, with excessively close-bite, were infinitely better treated by means of a removable appliance. Mr. Visick and Mr. Gray had in no way touched upon the question of excessively close-bite, which wrecked so many cases. It seemed to him that in the appliance Mr. Visick had described, he had not touched on those many cases of Class II, in which very close-bite was also present, and in respect of which the most trouble was in connection with the cure and control of the excessive incisor overbite. Taking the very case which Mr. Visick had described and illustrated on the blackboard, he wished to ask him how he controlled the excessive incisor overbite while retraction was going on. Many of these Class II cases had very close-bite indeed. One did very often treat them on palliative lines by leaving the jaw in its shortened state and getting harmony in the two jaws, extracting the maxilla and retracting, but before that was done one had to abolish the excessive close-bite. Mr. Visick had raised an extremely interesting point when he spoke about the breakage of arches and said it occurred near the attachment. In stainless steel appliances that occurrence had been noticed. The stainless steel arches tended to break at a point (indicated with reference to the diagram on the blackboard) where they were nowhere near any point of bending in the arch. That point was one on which the pliers never went. With regard to the annealing of arches and the breakage that occurred in finger springs, with these platinized gold appliances the Americans seemed to attach great importance to the question of the subsequent tempering of the appliance. He supposed that when the appliance was made and was quite passive, it was treated with acid and tempered by being heated to a red heat and then cooled. The Baker people employed a special sort of tempering pot, and they said that the higher the platinum content the more critical did this tempering

become. Some people seemed to think that fixed appliances were more in accord than removable ones with the natural processes of growth. The speaker did not think that was the case. The psychologic points on which Mr. Gray had touched were extraordinarily interesting, more particularly as concerned the mental picture that parents had regarding their children's deformities, which was so different from the picture formed by the orthodontist. He remembered, a few years ago, being introduced to a young woman who had a rather marked Class II deformity, at which, as an orthodontist, he was horrified; otherwise she was a good-looking person of twenty-two years. But a year later she married a relative of his own, and since then he had seen her frequently, and now he could tolerate quite well that gross deformity. That was obviously the point of view of parents, and to the extent that they regarded such deformities complacently they did not take too kindly to the energetic measures which orthodontists proposed on their children's behalf. If the same care and time and trouble were put into the fabrication and subsequent adjustment and manipulation of removable appliances, there would be very little to choose between the results obtained with removable and with fixed appliances respectively. It was the end of the journey which mattered, and if some people liked to go down to—say—Eastbourne in a Rolls Royce, others could accomplish the journey equally safely and quickly, though perhaps not equally comfortably, in a small mass-produced motor car of low horse power, such as so many of the junior members of the Society, among which he numbered himself, had perforce to be content with.

Mr. Visick, replying to Mr. Marsh and Mr. Downing, said he used to pull back the canines first as a routine method of treating these cases, but with further experience he found it unnecessary to do so; this was possibly because he was treating these cases much earlier, often before the canines were fully erupted, and one got the incisors back and the canines down into place. Even if the canines were fully erupted, they would go back perfectly well with the incisors, but one must not be in a hurry. Some of his best results had been obtained in cases where the patients had stayed away unexpectedly, and months afterward he had been astonished at the improvement that had taken place. Care should be taken to see that the arch did not cramp the canines.

He next spoke of the question of keeping back the molars, to which Mr. Marsh had alluded. The whole point was to make sure that the molar was a really fixed anchorage. If the band and arch fitted to the molar were all in one piece and absolutely rigid, this would be accomplished; but as the arch was not always a dead fit in the tube, there was a certain amount of movement there, which would allow the molar to tip forward. By putting a slight amount of spring in the arch one counteracted that movement and the molar became a really fixed anchorage.

Mr. Marsh.—It would not pull the front teeth back unless it came forward.

Mr. Visick replied that it probably did come forward, but the movement was too slight to be seen. He had met many cases where there were no clips on the incisors, and all that he knew was that those molars were going to tip forward. It was a case of pitting two forces one against the other. The reason why he did not like intermaxilliary traction in these cases was because it was more complicated. The procedure he had indicated had the advantage of simplicity. With regard to rotation, he often used just a band and spur on the rotated tooth, and he still used a ligature.

Mr. Badcock had spoken about his tools. A really skilled worker could make almost any sort of tool do the work. But he had had tremendous satisfaction in using the band pusher and band remover. He did not like to see a band with a lot of nicks cut in it and soldered up. They made the band clumsy and stiff. He liked the idea of the cast band on the canines.

With regard to Mr. Catchpole's difficulty with the mandible going to one side, he thought this was because the arch was not properly adjusted. The only thing was to put in an extra elastic band on the one side.

With regard to close-bite, he used to treat these cases by putting in a bite plate for six months, and then, when he had got about one-eighth of an inch between the mandibular

and maxillary incisors, he used a plain arch to retract the incisors. But of late years he had often dispensed with the preliminary bite plate, and found that as the maxillary teeth came back the bite seemed to adjust itself to the new position, the cingulum of the maxillary incisors acting in the same way as a bite plate on the mandibular incisors.

Mr. Cutler's allusion to the breaking point was interesting. Mr. Visick thought the metal broke at the point he had indicated because it was there that the bending took place, and the metal became tired and crystalline. That was why he advocated a band on a mandibular incisor to prevent the arch being lifted up and down by the tip of the tongue. With regard to the tempering, he liked to have the temper on the soft side. As to the respective merits of removable and fixed appliances, he could only say that he had found the appliances of which he had spoken infinitely superior in his hands to the removable appliances.

Mr. Gray, who also replied, agreed with Mrs. Possener Michaelis that one ought to try to find what had scared the patient. If that was known, it was always a great help. He had found it advisable to go gently with patients at first by trying to interest them, and once the interest was gained, they became faithful patients ever afterward.

With regard to the matter of fees, this had only been mentioned as a factor in stimulating the cooperation of the parents. In the paper Mr. Gray mentioned sending patients away, but he only recalled one boy with whom he could do little or nothing. This boy was so hopeless that he had been asked to leave his preparatory school, and later on had been expelled from the public school. Such a boy would tax any one's ingenuity to the fullest extent.

The vexed question of fixed *versus* removable appliances had been mentioned by several, but as the Society had asked for a paper on fixed appliances, the removable appliances did not come within the scope of the paper. As to which interfered least with natural growth, he thought that fixed appliances could be made much smaller and the pressures more gradual than with the removable appliance, and these movements were more in accord with the normal processes of growth and development.

COMMITTEE REPORTS PRESENTED BEFORE THE AMERICAN SOCIETY OF ORTHODONTISTS AT THE THIRTY-SECOND ANNUAL MEETING*

REPORT OF THE COMMITTEE ON ORTHODONTIC EDUCATION

Digressing somewhat from the schedule of study of the past three years, our work this year has enbraced three projects:

First, an effort to determine the appreciation and need of orthodontic knowledge by the general practitioner.

Second, a report of the curricular activities of the dental schools of the United States and Canada with respect to education in orthodontics.

Third, a report of the work done by the Committee on Orthodontics for the Curriculum Survey that is being conducted by the American Association of Dental Schools.

It is a well-known fact that dental education has made rapid strides during the past twenty-five years. Within the past decade the course of study in dentistry has advanced from three to six years. In several schools this increase in time has made it possible to augment greatly the time devoted to the basic sciences. This fact must be understood in order to appreciate the broader education in the biologic sciences now provided dental students over that offered them a few years ago. Through this expanded educational program the student is enabled to lay a substantial foundation for mastering problems of growth and development, and for understanding the principles and problems of orthodontics. The greatest need in orthodontic education today is the orientation of these fundamental sciences toward the field of orthodontics supplemented by ample demonstration of the application of these sciences to the treatment of cases. The graduate of today has a training that is equivalent to the dental course of fifteen years ago, plus two graduate years. Consequently, he is now sufficiently trained so that he should be able to grasp the principles employed in orthodontics.

It has been my good fortune to be associated with Dr. L. E. Blauch, executive secretary of the Survey of the Dental Curriculum of the American Association of Dental Schools, and it is to him I am indebted for much of the information and for the analyses in this report. These valuable data which have been collected for the survey have been given to your committee for study. I, therefore, feel a deep sense of gratitude to Dr. Blauch and the American Association of Dental Schools for the privilege of using this information in my report.

The Distribution of Orthodontists in the United State and Canada.—One aspect of the need of orthodontic education by general practitioners of dentistry is seen in the geographical distribution of orthodontists in the United States and Canada. *The Orthodontic Directory of the World* (1932 edition) lists 890 orthodontists in the United States. The distribution of these dental health practitioners among the states varies greatly. The five states with the largest numbers are: New York, 127; California, 108; Pennsylvania, 47; Michigan, 44; and Illinois, 41. Two states, Montana and Wyoming, have only three orthodontists each; two, Delaware and New Mexico, have only two orthodontists each; and eight states, Idaho, Mississippi, Nevada, New Hampshire, North Dakota, South Dakota, Utah, and Vermont, have only one orthodontist each.

The orthodontists in the United States reside in cities, particularly the larger cities, which include only 36 per cent of the population. To be sure, a somewhat larger percentage of the population than that indicated has access to orthodontic service, since the people residing in a community near a city can take advantage of the opportunities available in the city, but these opportunities may frequently be had only with much inconvenience and considerable expense.

*Oklahoma City, November, 1933.

A similar situation is found in Canada. Only 26 orthodontists are listed for the Dominion, and they are distributed as follows: Ontario, 15; Quebec, 4; British Columbia, 3; Manitoba, 3; and Nova Scotia, 1. No orthodontists are listed for the other four provinces. The cities in which the orthodontists reside include only 26 per cent of the population.

It is obvious that with the distribution of orthodontists as at present, most of the people cannot have orthodontic service unless general practitioners provide some of it. In all probability there will be a somewhat wider distribution of orthodontists in the future, but there is no reason to think that they will ever be so located as to make their services easily available to all the people, owing to the fact that in a small community there is not a sufficient demand for the services of a specialist to justify the establishment of an office.

Orthodontics and General Practitioners of Dentistry.—The situation portrayed by the data just presented suggested a study of the orthodontic services rendered by general practitioners of dentistry. Information was sought on two questions: first, what percentage of practicing dentists render orthodontic service; and second, what is the nature of their service?

A study made in 1929 under the auspices of the American Dental Association disclosed that 32.3 per cent of 4,934 dentists in general practice in twenty states included orthodontics in their practice. There was much variation among the states in this report, 63 per cent of the general practitioners in Wisconsin and only 14 per cent in Arizona reporting that they gave orthodontic service.

The practice of orthodontics by general practitioners of dentistry was further studied through a questionnaire which was sent to 985 alumni of the various dental schools, who were regarded by the schools as progressive and successful in the general practice of dentistry. Replies were received from 519 dentists. These men reside in all sections of the country; and their reports may, therefore, be regarded as representing a fair cross-section of American dentistry as practiced by the better members of the profession. According to the reports, 44 per cent of these dentists include some orthodontics in their practice, 40 per cent stating that less than 25 per cent of their practice consists of this service, 3 per cent stating that orthodontic service constitutes from 25 to 49 per cent of their practice, and 1 per cent stating that this service occupies from 50 to 99 per cent of their time. Also, a large number of the dentists stating that they render no such service, say that they recognize cases of malocclusion and advise patients regarding conditions, and a considerable number indicate that they try to arrest and prevent cases of malocclusion, some definitely stating that they use space maintainers for this purpose. The facts presented show clearly that orthodontics has a place in the general practice of dentistry at present. Moreover, it is obvious that many general practitioners leave this field of oral health service to other general practitioners of dentistry or to specialists in orthodontics.

The questionnaire sought additional information on the types of orthodontic service given by the dentists and on their training for, and evaluation of this service. It also requested opinions regarding education in orthodontics for the undergraduate student of dentistry.

The preventive aspects of orthodontics seem to receive a fair degree of attention from dentists. Approximately 78 per cent of the dentists replying state that they recognize cases of malocclusion and advise patients regarding conditions. Also, 44 per cent definitely indicate that they treat to arrest malocclusion, and it may be assumed from the replies that another 8 per cent give similar service. On the basis of this evidence, the conclusion is warranted that more than 50 per cent of the progressive and successful dentists in general practice attempt in various ways to prevent the development of malocclusion.

A substantial number of general practitioners go beyond preventive treatment of malocclusion. About 40 per cent of the dentists replying state that they treat orthodontic cases. Most of these practitioners deal with the less complicated cases only, but a goodly proportion handle all except the most difficult cases, and thirty dentists treat all cases. A few dentists treat cases of malocclusion under the advice and direction of an orthodontist.

Additional light on the practice of orthodontics by general practitioners of dentistry is obtained from the ways by which these dentists obtain the orthodontic appliances used by them. Approximately 64 per cent of those who replied stated that some or all appliances are

made by them or by technicians employed by them. The data indicate that a considerable percentage of the dentists who treat cases of malocclusion purchase some or all appliances ready-made or have them made by commercial laboratories. This is indeed a deplorable condition, but in this respect orthodontic service is probably not very different from several other types of dental service. If there is a desire on the part of almost half of the progressive dentists to render orthodontic service, it seems obvious that the dental schools should include sufficient training in their courses of study to enable these dentists to make their own appliances, and be capable of regulating some of the less complicated cases of malocclusion.

Only 23 general practitioners of dentistry of the 200 who treat cases of malocclusion have had (some) special training for this work, either in a special school of orthodontics or in a dental school, and only 35 have had practice with an orthodontist. A few others have had courses in orthodontics in study clubs. The obvious conclusion is that the great majority of the dentists have had no training in orthodontics except that provided by the undergraduate curriculum in dentistry. To be sure, some of them have read publications on orthodontics, heard discussions of the work, and observed clinics, but their organized and systematic training in this field of study and practice ended when they were graduated from dental school.

The value of orthodontics is recognized by practically all the men reporting. The great majority of the dentists think the treatment is "of great value to the patient" though some of them suggested that the treatment is of great value when given by an orthodontist. No dentist stated that he regarded orthodontic treatment of little or no value. A few, however, observed that they had seen cases where much damage had been done in an effort to treat by men who were incompetent.

From the facts and opinions obtained, it is possible to outline the practice of orthodontics by general practitioners of dentistry today. A considerable percentage of these men give orthodontic service, but the actual amount done by them is apparently not large. The majority of the dentists who treat cases construct the appliances or have them constructed by technicians in their employ, but it is not unusual to find that the appliances are obtained in other ways. Most of the dentists who stated that they treat cases of malocclusion have had no systematic training in orthodontics beyond that supplied by the regular undergraduate curriculum in dentistry. In general, it may be said that the dentists regard very favorably the orthodontic treatment that they have observed.

An important part of the questionnaire study was to obtain the opinions of the dentists regarding the training in orthodontics that should be given to undergraduate dental students. The replies indicate that the dentists believe training in orthodontics should constitute an important feature of the undergraduate curriculum. Only 12 dentists think no such training should be provided. Training in the recognition of malocclusion and in preventive treatment received overwhelming majorities of the votes. More than three-fifths (68 per cent) of the dentists think the future general practitioner of dentistry should be trained in his regular dental curriculum to *treat* cases of malocclusion. Most of the dentists think the training should prepare the students to treat the simpler cases, but more than one-fourth of them suggest that the training should prepare the undergraduate to handle more difficult cases. A few dentists hold the opinion that undergraduates should be trained to treat cases of malocclusion under the advice or direction of an orthodontist.

The facts and opinions stated above suggest that the dental schools are confronted with the problem of formulating a course of study in orthodontics whereby the undergraduate student of dentistry may acquire sufficient knowledge and ability to treat some of the less complicated cases of oral anomalies. His understanding of the subject should also be sufficient to warn him of the cases that are too difficult for him to treat successfully. When we consider that most of us launched out upon the turbulent practice of orthodontics with but comparatively short courses of postgraduate study, it does not seem to be asking too much of the present-day graduate to absorb this much additional knowledge in his enlarged study of dentistry. This will care for the increased demand for orthodontic service and afford an opportunity to those men who desire to do some orthodontics.

Education in Orthodontics in the Dental Schools.—The second part of this report has to do with the attitudes of the dental schools toward this problem and their efforts to aid in

its solution. Your committee cooperated in the preparation of a questionnaire which was sent to the dental schools in 1932 by the Curriculum Survey Committee of the American Association of Dental Schools. It sought information on the purposes of orthodontic education, and the instruction in this subject offered by the dental schools.

Practically all the dental schools agree on three purposes of undergraduate orthodontic education, namely, (1) to give students an appreciation of orthodontics, (2) to teach students to recognize cases of malocclusion, and (3) to teach students to prevent malocclusion. Almost equally important in the estimation of the schools are four other purposes: first, to aid students in understanding other fields of dentistry; second, to prepare students to advise patients regarding orthodontic cases; third, to teach students to understand the dangers in orthodontic treatment unless done by one who is thoroughly competent; and fourth, to prepare students to arrest cases of malocclusion.

It is gratifying that 29 of the 43 dental schools in the United States and Canada favor a sufficient amount of orthodontic education in the undergraduate curriculum to enable the graduate to treat at least the less complicated cases. Ten of these schools express themselves as favoring the instruction of undergraduates in orthodontics to the extent of teaching them to treat all except the most difficult cases. One school through a special elective curriculum teaches the students electing the special curriculum to treat all cases.

This variation in the purposes of education in orthodontics is reflected in the curriculums of the dental schools. Every school offers didactic instruction in orthodontics, usually in the two last years. The amount of time devoted to it varies from 16 to 80 hours with an average of 43 hours. All but one of the schools teach orthodontic technics through laboratory exercises, and the time devoted to this phase of the work varies from 17 to 176 hours with an average of 52 hours.

The lack of common agreement on orthodontic education for the undergraduate student of dentistry is clearly shown in the clinical instruction. Only 25 dental schools report that they require all students to pursue the clinical study of orthodontics, and 17 schools report that this study is optional with the students. One school gives no clinical instruction at all. Definite information accompanying the reports indicates that the clinical instruction in several schools consists entirely of demonstrations, the students treating no cases. In 17 schools the instructors make the clinical adjustments of orthodontic appliances, and 21 schools report that the students adjust the orthodontic appliances, the instructors assisting in 6 of them. The appliances are made by the students in 23 schools; they are made by demonstrators or technicians in 18 schools; and 4 schools report that the appliances are purchased ready-made. The amount of time devoted by the undergraduate to the clinical study of orthodontics was reported by 36 dental schools. It ranges from 16 hours (the lowest) to 260 hours (the highest), with an average of 83 hours.

The Survey of the Dental Curriculum.—The third part of this report deals with the aims and purposes of the Survey of the Dental Curriculum, which is being conducted by the American Association of Dental Schools. The project is supported by a grant from the Carnegie Corporation of New York, It has been under way for more than two years.

This undertaking is intended not to survey existing practices in dental education but rather to plan a course of study in dentistry that will be based upon the requirements of modern dental health service. Specifically, the aims of the survey are threefold: (1) to discover the modern requirements of dental health service; (2) to determine the knowledge and skill that should be possessed by the dentist to render this service; and (3) to develop a dental curriculum that will adequately prepare the undergraduate to render dental health service.

The need for dental service and its requirements have been studied through a search of dental literature and through a canvass of the opinion of laymen, physicians, public health officials, and dentists. In order that every part of the dental course of study may be thoroughly considered, dental education has been divided into fields of study according to the services rendered by dentistry. Each field has been assigned to a committee of dental teachers to determine what should be taught to the students in that branch so that they may be prepared to begin the general practice of dentistry. The committee on orthodontics consists of

Dr. Abram Hoffman and myself. This committee, working under the direction of the executive secretary of the survey, has formulated tentatively a course of instruction in orthodontics for undergraduate students of dentistry.

In formulating the course of instruction in orthodontics the committee has had in mind the great need for orthodontic service which is not now being met. It has been estimated that nearly one-half of the families of the United States have an annual income of less than $2,000. These families cannot possibly afford to pay from $200 to $300 per child per year for orthodontic treatment. The best of orthodontic service is none too good for any child. However, the question may well be raised whether orthodontists have not let their conception of perfection and scientific idealism prevent them from reaching the great mass of children who are in need, and whether they have not made it impossible for the great majority of individuals to have orthodontic service. We must now be concerned about orthodontic service for the economically less fortunate. There is no doubt that the problem must be solved by the dental profession, or we may later be embarrassed by having a solution forced upon us. The committee which has prepared the course of instruction on orthodontics is of the opinion that the masses of children can be largely cared for by the general practitioner of dentistry. Furthermore, it is of the opinion that if this work is properly done, there will be much work for the specialist owing to the fact that a considerable number of cases will be beyond the range of ability of the general practitioner.

It is apparent from the statements just made that education in orthodontics is receiving full attention in this extensive effort to improve dental education. It is gratifying that steps are being taken to place orthodontic educational requirements on a par with those of other phases of dental health service.

EARL G. JONES, CHAIRMAN.

REPORT OF COMMITTEE ON LEGISLATION

In the spring of 1932 we were advised that Congress was considering imposing a tax on precious metals used in dentistry, the matter then being before the Ways and Means Committee of the House of Representatives.

A vigorous protest by the Legislative Committee of the A.D.A. as well as by many state and local dental societies, trade organizations and individuals, including orthodontists, brought forth a denial that such action was being or had been contemplated by Congress, and the subsequent passage of the Revenue Act of 1932 containing no definite mention of a tax on dentistry was later offered in substantiation of this denial.

All this occurred before the last annual meeting of the American Society of Orthodontists, at which time all immediate danger of a luxury tax being imposed on dentistry was believed to have been passed. However, early in July, 1932, we were amazed to learn that the Bureau of Internal Revenue had constructed Section 605 of the Revenue Act of 1932 as applying to precious metals used in dentistry and ruling that a tax would be imposed thereon.

Protests to the Internal Revenue Department being unavailing, appeal was then made to the Ways and Means Committee of the House. This committee avowed that there had been no intention by the committee or the Congress to impose a tax on dentistry.

A Joint House Resolution introduced in the House and referred to the Ways and Means Committee construing the Revenue Act of 1932 read in part as follows:

"JOINT RESOLUTION, To construe the Revenue Act of 1932.

"Sec. 2. That nothing contained in Section 605 of the Revenue Act of 1932 shall be construed as imposing a tax on articles manufactured for and / or used in the practice of surgery or dentistry."

Following the introduction of this Resolution, the Bureau of Internal Revenue rescinded the ruling construing the act as applying to dentistry and imposing a tax on precious metals used in the practice thereof.

The activity of the Legislative Committee of the A.D.A. and other organizations and individuals cooperating is to be commended in having secured the successful termination of this menace.

The greatest problem which requires our attention at present is the increased cost of gold and material containing that metal. The economic ramifications of this subject and its discussion carry us afar, and it is therefore considered inadvisable to do more than state a few superficial facts. We refer those who have a further interest in the matter to the Committee on Legislation and Correlation of the American Dental Association.

It is believed that the situation cannot be better described than by quoting from a letter dated October 4, 1933, and signed by the Acting Secretary of the Treasury.

"Under the Executive Order of April 5, 1933, persons having a legitimate use for gold in industry, profession or art could obtain a license through a Federal reserve bank and withdraw gold for such use by paying $20.67 an ounce. Due to the demand for gold in foreign markets and the exchange situation, the proceeds of gold sold abroad amounted to approximately $28 to $30 an ounce. In normal times the bulk of the gold used in industry, profession and art was obtained from scrap gold, but in the face of this situation scrap gold was being withheld and the burden of supplying the gold fell upon the Federal Reserve Banks. The gold thus supplied depleted by that amount the stock of gold held for monetary purposes.

"The Executive Order of August 28, 1933, revoked the Order of April 5, 1933; and the Executive Order of August 29, 1933, authorized the Secretary of the Treasury to receive on consignment for sale gold recovered from natural deposits in the United States. This gold is first offered for sale to persons licensed to acquire gold for use in the arts, industries and professions, and thereafter abroad, at a price determined to be equal to the best price obtainable in the free gold markets of the world. The effect of such Executive Order was to preserve existing stocks of gold and to recall in active use the accumulation of scrap gold. Commodity gold is, therefore, sold at the price agreed upon between the contracting parties. This price should never exceed the world price, because all newly mined gold is offered at that price. It may, however, fall below that price depending upon the demand for, and supply of, scrap gold."

From the information and statements which your committee has at hand, there appears to be no doubt but that precious metal alloys were not reduced when the metals which go to make up their content were reduced. Just why no reduction was made has not been ascertained.

Since the price of gold has advanced from $20.67 an ounce to almost $32, it follows as a logical sequence that all materials containing gold have been advanced accordingly. The dental profession recognizes this condition and accepts it. We do, however, discern and object to a tendency on the part of the "gold manufacturers to increase the cost far beyond the gold content" in alloys containing that metal. It should be said to the credit of the gold dealer that the operation of the NRA probably increases his cost of doing business, and that the increase of the selling price to the dentist is not alone due to the increased price of gold. From what we can see at the present time, there seems to be no possibility that the dentist will be exempted from participating in the increased cost of gold. It has been suggested, and your committee offers it for your consideration, that the orthodontist do his part in absorbing this extra expense in order that the children will not suffer for the lack of orthodontic treatment which already has been and is being too long delayed.

Respectfully submitted,
(Signed) ALLEN EVERETT SCOTT,
HENRY F. HOFFMAN.

REPORT OF RESEARCH COMMITTEE

The most outstanding research is that carried on at Western Reserve University at Cleveland. Broadbent and Todd are at the head of that. I am sure that the future has much in store for orthodontia from their studies on growth and development.

Dr. A. Leroy Johnson has been carrying on some investigations on dogs at Dr. Stockard's experimental farm. It is to be expected that Johnson will have some important contribution on heredity and environment in the near future.

My own work is progressing slowly but satisfactorily. In addition to the study of skeletal material and of the children in practice, I am now investigating the problem of presence and absence of the third molar teeth in modern man. This study is conducted on students at Columbia University. My studies on the growth and development of the face are

EXHIBIT 1

UNITED STATES PUBLIC HEALTH SERVICE
DENTAL EXAMINATION

LAST NAME ..... FIRST NAME ..... CITY OR COUNTY ..... STATE .....

DATE ..... AGE ..... SEX ..... COLOR ..... SCHOOL ..... GRADE .....

FOR DETERMINATION OF DENTAL NEEDS, EXAMINATION COVERING ITEMS 1 TO 8 IS NECESSARY

1. IS DENTAL TREATMENT INDICATED? YES ..... NO .....

USE CHECK (✓) WHERE POSSIBLE

2. HAS CHILD EVER RECEIVED DENTAL TREATMENT?
   - NONE .....
   - PROPHYLAXIS .....
   - FILLINGS .....
   - EXTRACTIONS .....

3. NUMBER OF TEETH WHICH HAVE BEEN FILLED, DECIDUOUS ..... PERMANENT .....

4. NUMBER OF TREATMENTS INDICATED

	DECIDUOUS	PERMANENT
EXTRACTIONS		
FILLINGS		
PROPHYLAXIS		

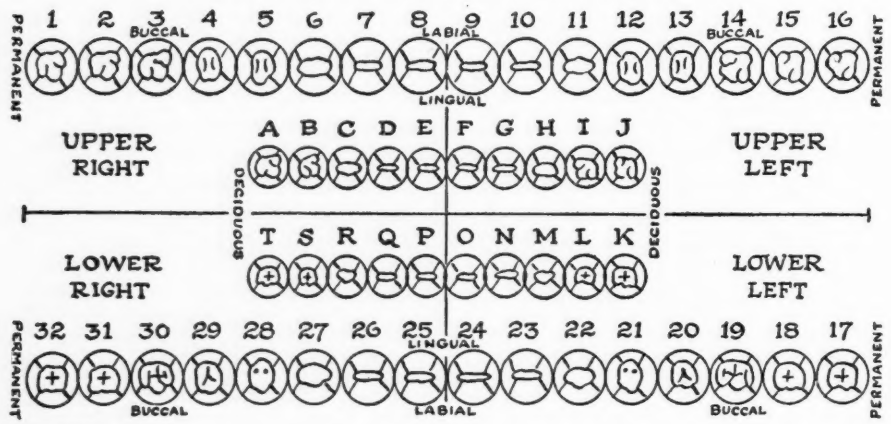
5. NUMBER OF MISSING TEETH (EXTRACTED PERMANENT TEETH ONLY) ....

6. CONDITION OF GUMS NORMAL ..... DISEASED .....

8. MALOCCLUSION
   - NONE .....
   - SLIGHT .....
   - EXTENSIVE .....

7. IS ORTHODONTIC TREATMENT INDICATED AS A HEALTH MEASURE? YES ..... NO .....

FOR COMPLETE DENTAL EXAMINATION, EXECUTE CHART BELOW



✓ EXTRACTION INDICATED; Z MISSING; O ABSCESS; X ROOTS; — FILLING IN GOOD CONDITION; # DEVITALIZED.

1. PLACE DIAGNOSTIC SYMBOL BELOW DESIGN CORRESPONDING TO TOOTH OR AREA BEING EXAMINED.
2. CARIES; OUTLINE CAVITY ON DESIGN, SHOWING SURFACE OF TOOTH INVOLVED.
3. IS MOTTLED ENAMEL PRESENT? YES ..... NO .....

beginning to point the way to a more satisfactory diagnosis and a more reliable prognosis regarding malocclusion of the teeth.

A survey of child dental health conditions under the auspices of the Committee for Dental Health Survey of the American Dental Association, is being conducted by the United States Public Health Service under the direction of Colonel C. T. Messner, Chief of the Dental Division. This survey is progressing very satisfactorily with the cooperation of the majority of the health agencies and dental societies of the great majority of the states. This promises to be the most extensive research of this kind ever conducted. Over one million questionnaires have been distributed among the aforementioned agencies. It is expected that the total number of questionnaires will reach five million. Tabulations of malocclusions have been accorded adequate space.

(See form submitted, Exhibit No. 1)

Members should note reports of the progress of the work as they appear in the journals.

The Bureau of Standards, Washington, D. C., has made satisfactory progress in those investigations into orthodontic wrought gold alloys reported by this committee last year. In addition to these, an extensive investigation into the properties of oxyphosphate cements is being conducted.

The research conducted by Drs. McCullom and Klein, known as the McCullom swine breeding experiment, also referred to in last year's report, has been concluded and final reports will appear during the coming year.

The findings of greatest interest relate to the influence of selected diets upon the mother and offspring during gestation and lactation.

The orthodontic research at the Merrill-Palmer School in Detroit will be continued through Dr. Samuel J. Lewis making further radiographic and model records of the eighty-five children who have been under observation for periods of from five to ten years.

George Stiles, M.D., bacteriologist in the U. S. Bureau of Animal Husbandry, with headquarters in Denver, has supplied us with bulletins published by the Agricultural Departments of several of the different states ranging from Florida to California and from Montana to Texas, and also bulletins from the United States Department of Agriculture. These bulletins deal with mineral deficiencies in soils, rickets in cattle, diet requirements for fertility and lactation, etc. American Society of Orthodontists members should endeavor to stimulate the Agricultural Departments of the several states to increased activity in analyses of soils and food products. (See list of publications, Exhibit No. 2.)

EXHIBIT NO. 2.

Diet in Relation to Disease of the Supporting Tissues. By John Albert Marshall, D.D.S., Ph.D., San Francisco, Calif., J. A. D. A., December, 1927.

Acid and Base-Forming Elements in Foods. By Guy W. Clark, from the California Stomatological Research Group and the Division of Biochemistry and Pharmacology, University of California, Berkeley, July 6, 1925.

The Status of the Etiology of Caries From the Standpoint of Nutrition and Salivary Chemistry. By John Albert Marshall, D.D.S., Ph.D., Pacific D. Gaz., June, 1932.

The Cause of Mottled Enamel, a Defect of Human Teeth. By Margaret Cammack Smith and Edith M. Lantz, Department of Nutrition, and H. V. Smith, Department of Agricultural Chemistry, University of Arizona, College of Agriculture, Agricultural Experiment Station, June 10, 1931, Technical Bulletin No. 32.

Mottled Enamel in Arizona and Its Correlation With the Concentration of Fluorides in Water Supplies. By H. V. Smith and Margaret Cammack Smith, University of Arizona, College of Agriculture, Agricultural Experiment Station, July 15, 1931, Technical Bulletin No. 43.

Experimental Production of Mottled Enamel. By Margaret Cammack Smith and Edith M. Lantz, University of Arizona, College of Agriculture, Agricultural Experiment Station, January 1, 1933, Technical Bulletin No. 45.

The Cause of Mottled Enamel. By Margaret Cammack Smith, M.A., Ph.D., Edith Lantz, M.A., and Howard V. Smith, M.S., Agricultural Experiment Station, University of Arizona, Tucson, Arizona, J. D. Res. **12**: February, 1932.

The Relation of Calcium and Phosphorus in the Diet to the Cause of Mottled Enamel of Human Teeth. By Ruth M. Leverton and Margaret Cammack Smith, J. Home Economics **24**: December, 1932.

The Presence of Fluorine in the Water Supply of Colorado and Its Relation to the Occurrence of Mottled Enamel. By C. H. Boissevain, M.D., Colorado College, Colorado Springs, Colorado, Colorado Medicine, April, 1933.

A Field and Laboratory Test on Plant Material for Diagnosing Phosphorus Deficiencies. Purdue University, Agricultural Experiment Station, Lafayette, Indiana, February, 1932, Bulletin No. 355.

Bone Chewing by Cattle. By Howard Welch, Veterinarian, University of Montana, Agricultural Experiment Station, Bozeman, Montana, January, 1924.

Chemical Analyses of Montana Soils. By Edmund Burke, Chemist, and R. M. Pinckney, Assistant Chemist, University of Montana, Agricultural Experiment Station, August, 1923, Bulletin No. 159.

Easily Soluble Phosphorus in Oklahoma Soils. By Horace J. Harper, Professor of Soils, Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Stillwater, Oklahoma, September, 1932, Bulletin No. 205.

Hilgardia, A Journal of Agricultural Science. By the California Agricultural Experiment Station; Some Effects of Varying Calcium and Phosphorus Intake on the Estrus Cycle and Reproduction in the Rat. By H. R. Guilburt and G. H. Hart, University of California, Berkeley, Calif. **5**: December, 1930.

Factors Influencing Percentage Calf Crop in Range Herds. By G. H. Hart and H. R. Guilburt, University of California, College of Agriculture, Berkeley, Calif., September, 1928, Bulletin No. 458.

Mineral Content of Southern Poultry Feeds and Their Potential Acidity and Potential Alkalinity. By the North Carolina Department of Agriculture and the North Carolina State College of Agriculture and Engineering, December, 1920, Bulletin No. 19.

Salt Sick: Its Cause and Prevention. Mineral Supplements for Cattle. By R. B. Becker, W. M. Neal, and A. L. Shealy, University of Florida, Agricultural Experiment Station, Gainesville, Florida, June, 1931, Bulletin No. 231.

Vitamins in Food Materials. By Sybil L. Smith, Senior Chemist, Office of Experiment Stations, United States Department of Agriculture, November, 1929, Circular No. 84.

Deficiencies in Rations Devoid of Roughage for Calves. 1. The Effect of the Addition of Cod Liver Oil and Alfalfa Ash. By S. W. Mead and W. M. Regan, Division of Animal Husbandry, University of California, Davis, Calif. **14**: July, 1931.

A Mineral Deficiency in the Rations of Cattle. By C. H. Eckles and R. B. Becker, Division of Dairy Husbandry, L. S. Palmer, Division of Agricultural Biochemistry, University Farm, St. Paul, Minn., June, 1926, Bulletin No. 229.

A Bacteriological Method for Determining Mineral Soil Deficiencies by Use of the Soil Plaque. By Walter G. Sackett and Laura C. Stewart, Colorado Experiment Station, Colorado Agricultural College, Fort Collins, Colorado, November, 1931, Bulletin No. 375.

Dietary Requirements for Fertility and Lactation. University of Arkansas, College of Agriculture, Agricultural Experiment Station, Fayetteville, Ark., June, 1930, Bulletin No. 252.

Should Leg Weakness in Growing Chicks Be Called Rickets? By J. S. Hughes and R. W. Titus, Department of Chemistry, Kansas State Agricultural College, Manhattan, Kansas, J. Biol. Chem. **49**: August, 1926.

The Manganese-Copper-Iron Complex as a Factor in Hemoglobin Building. By R. W. Titus, H. W. Cave, and J. S. Hughes, with the cooperation of H. L. Kent, Kansas Agricultural Experiment Station, Manhattan, Kansas **80**: December, 1928.

Feeding Bone Meal to Range Cattle on the Coastal Plains of Texas. Division of Veterinary Science, Texas Agricultural Experiment Station, July, 1926, Bulletin No. 344.

The Increase in the Calcium of Hens' Blood Accompanying Egg Production, Science, Department of Chemistry, Kansas State Agricultural College **65**: 264, March 11, 1927.

Manganese as a Factor in Hemoglobin Building. Science, Kansas State Agricultural College **68**: 410, October 26, 1928.

EXHIBIT NO. 3.

CHILD RESEARCH COUNCIL OF DENVER

REPORT OF WORK OF CHILD RESEARCH COUNCIL FOR THE RESEARCH COMMITTEE OF THE AMERICAN SOCIETY OF ORTHODONTISTS

The Child Research Council of Denver is an institution for the study of children. Incorporated in the state of Colorado in 1927, it became affiliated with the University of Colorado School of Medicine in 1928 and has since been housed in the medical school buildings while retaining its character as an independent research institute. Its purpose is to add to

our knowledge of growth and development during health or as altered by various disease processes during the childhood years. Because it is concerned with the study of the whole child rather than with any one part of the body or any one group of diseases, its method is somewhat different from that used in most such investigations.

A group of 100 children is being followed from birth to maturity. Each individual child is checked every three to six months by means of (1) a complete pediatric examination; (2) special examinations of the upper air passages, the lungs, the heart, the bones, joints and muscles, the physical bodily measurements, the face, jaws and teeth, and the psychologic and mental aspects of the child's development; (3) roentgenograms of the head, jaws, lungs, heart, spine and gastrointestinal tract; (4) electrocardiograms of the heart; (5) basal metabolism determinations; and (6) occasional miscellaneous laboratory tests.

A staff of 52, composed of physicians and scientists representing many different specialties, is needed to carry forward this study. In the clinical follow-ups, 12 practitioners are actively at work and 10 more serve as consultants. In addition to these intensive observations of growing children the council maintains full-time research fellows in the departments of anatomy, bacteriology, biochemistry, clinical pathology, pathology and physiology, of the school of medicine. Eight of the scientists on the school faculty are actively engaged in directing and assisting these fellows in their laboratory problems which are all closely related to the central study of the whole child.

Fellows in orthodontia, pediatrics and radiology carry on a combined program of clinical follow-ups and investigations. Dr. Charles Waldo, full-time fellow in orthodontia, joined the staff in August, 1932. His first two months were spent in studying the methods and results of the various dental research projects in several eastern centers. Valuable assistance was given by Dr. Sam Lewis of Detroit, Dr. Holly Broadbent of Cleveland, and many others, in preparing Dr. Waldo for the start of the Child Research Council studies. The stage of organization and equipment is now passed, and the actual observations of the development of facial bones, jaws, and teeth are well under way.

The methods being used are not new, consisting of clinical observations and measurements, photographs, impressions, and x-ray pictures. The distinguishing characteristic of the work is, rather, its close integration with the whole project of the Child Research Council in which every aspect of these children is receiving the most intensive study from the time they are born until they reach maturity. This should lead eventually to definite and reliable conclusions concerning not only the development of jaws and teeth but also the relationship between disorders in these structures and such other important considerations as (1) nutrition, (2) general skeletal growth and development, (3) general health, (4) the development and diseases of the nasal accessory sinuses and the nose and throat, (5) the results of infections, (6) metabolic disorders, and (7) the possible psychologic aberrations associated with malformations and developmental difficulties in the region of the face and jaws.

EXHIBIT NO. 4.

October 17, 1933.

The following progress report on orthodontic research is submitted by the committee from the Pacific Coast Society of Orthodontists to the American Society of Orthodontists.

ALLEN E. SCOTT
B. FRANK GRAY
ROBERT DUNN.

Report on orthodontic research from June, 1932, to date.

The title of Dr. Marshall's paper for the Oklahoma meeting is as follows: "The Classification, Etiology, Diagnosis, Prognosis and Treatment of Radicular Resorption of Teeth." By John Albert Marshall, Ph.D., D.D.S., University of California.

The various resorptive processes are classified and their histopathology is briefly reviewed. Comparisons are made from lesions found in new material with those hitherto reported, and the findings confirm and elaborate those which have been previously described.

One interesting development in the study this year has been the preparation of a series of slides showing decalcified enamel matrix. This tissue, heretofore seen only in small

fragments, is now demonstrated throughout its thickness, from the dentoenamel junction to the periphery of crown. Photomicrographs showing decalcified enamel matrix magnified 1,000 diameters have been made. The study is of particular significance to deficient diets and to the tooth and bone formation. Thus the problem of mineral metabolism becomes linked even more closely with dental development.

Dr. Marshall emphasizes the following points which are quoted directly:

"The prognosis and treatment of orthodontic cases in which malnutrition is a factor should be shared with the pediatrician, and his aid secured.

"There is no truer example of preventive dentistry than the pevention of certain types of pathological radicular resorption. The response which the alveolar process may be expected to make to orthodontic treatment is governed by the efficiency with which the organism can utilize the various dietary substances concerned in bone growth."

The funds for Dr. Marshall's research have been expended and the work has stopped, but the problem is not fully solved. Additional experiments should be started dealing with the movements obtained by different appliances. Further data should be collected upon diets by utilizing other animals.

The committee believes that this work should be started again as soon as practicable. Whether any smaller sum than $3,000 would permit Dr. Marshall to go on with the work outlined might be determined from discussion with him at Oklahoma City. It is well to remember the excellent work that has been done and to consider what might be lost if completion of the research were long postponed.

Your committee chairman has conferred with Dr. Marshall and submits the following:

Since July 1, 1933, Miss L. Noble, technician in histopathology, has been employed in other laboratories. She is willing to return to this research if she can be assured of $70 per month, working on a part-time basis (formerly she received $150 per month working on a full-time basis). This means $840 for Miss Noble's salary, and $160 for purchase of supplies required in the laboratory, or a total of $1,000.

There remains a certain amount of valuable material, consisting of the heads and jaws of monkeys which should be sectioned and made into slides; then these can be studied by Dr. Marshall. Having this valuable material available, it would seem to be a waste not to receive the benefit of its utilization.

ALBERT H. KETCHAM, Chairman.

REPORT OF COMMITTEE ON NECROLOGY

IN MEMORIAM RESOLUTIONS

Martin Dewey

Martin Dewey, distinguished orthodontist, author, teacher, prominent member of the dental profession, and a past president of this Society, passed away suddenly at his home in New York City, May 14, 1933.

Dr. Dewey was born in Wichita, Kansas, in 1881 and received his preliminary education in the schools of Wichita. He obtained his degree of doctor of dental surgery at Keokuk Dental Medical College in 1904. After receiving his medical and dental degrees he entered the Angle School of Orthodontia in St. Louis, from which school he was graduated in one of its first classes. For some years after, he was an instructor in the Angle School. In 1910 he became professor of orthodontia and anatomy at Kansas City Dental College. Later he served as head of the orthodontia department at the University of Iowa Dental School. Following this he practiced in Chicago for a short time, and in 1921 he went to New York to become head of the orthodontia department of the School of Dental and Oral Surgery of Columbia University. Later in New York, he established the Dewey School of Orthodontia. As an organizer and parliamentarian he was without a peer, and because of these talents he had served in many capacities in organized dentistry and in his specialty of orthodontia. He had served as secretary and president of the Kansas City Dental Society. He was also a past president of the First District Dental Society of New York, and was president of the

American Dental Association for the year 1931-1932. He was author of *Practical Dentistry* and *Comparative Dental Anatomy* and made many other contributions to dental literature. For years he served as editor of the INTERNATIONAL JOURNAL OF ORTHODONTIA. Dr. Dewey was a member of the Psi Omega dental fraternity, the New York Athletic Club, and the Columbia Yacht Club.

Dr. Dewey is survived by his wife, Muriel de Forrest Dewey, and his mother, Mrs. Emma Wolfe Dewey.

WHEREAS this Society has lost one of its most resourceful workers and members, whose efforts have contributed greatly to the affairs of this Society, be it hereby

Resolved That this resolution become a part of the minutes of the Society.

William Cummins Fisher

In the death of William Cummins Fisher the American Society of Orthodontists has lost one of its most loyal, energetic and distinguished members, and one of its past presidents.

Dr. Fisher was born in Washington, D. C., July 14, 1876. He attended the public schools of Washington and later received his dental degree at George Washington University in 1899. He later attended McGill University at Montreal, Canada, and the University of Dublin, Dublin, Ireland. He practiced for a time in London and then entered the Army Dental Service from which he resigned to enter general practice in New York City.

During the World War he held the rank of major in the Dental Corps and served at the Debarkation Hospital in New York City. After the war he held the rank of lieutenant-colonel of the Dental Reserve Corps and later advanced to the rank of colonel, which commission he held at the time of his death.

He was the founder and president of the First International Orthodontic Congress held in New York City in 1926, and it was through his efforts that this Congress was a notable success.

He was instrumental in the organization of the New York Society of Orthodontists, being one of its past presidents. He also was a past president of the Dental Society of the State of New York. He served as president of the Association of Military Dental Surgeons and was chairman of the Section of Stomatology of the American Medical Association. He also was a member of the American Dental Association and the Institute of Dental Technique of New York.

Because of the many accomplishments, the superb record, and the warm fellowship which is so very much missed by all who came in contact with him, be it hereby

Resolved That this memorial become a part of the minutes of this Society.

Milton Tate Watson

The passing of Milton Tate Watson has taken from this Society one of its charter members who served the organization as president on two occasions, first in 1903, and again in 1912.

Dr. Watson was born on a farm near Ann Arbor, Michigan, January 16, 1872. He received his early education in the public schools of Jackson, Michigan, and was graduated in dentistry from the University of Michigan in 1893. In 1895 he was married to Genevieve C. Ryan at Ypsilanti. He practiced for a time in Jackson but soon moved to Bay City where he continued practice until 1900. In that year he entered the first class of Dr. Edward H. Angle in St. Louis. He was thus one of the pioneers in orthodontia who was to help establish it as a specialty. He served as an instructor in the Angle School and was a lecturer on orthodontia in the Dental Department of the University of Michigan for a number of years. Poor health forced his retirement from practice several years ago.

Besides his membership in this Society, he was a member of his local, state, and the American Dental Society. For forty-three years he had been a member of Delta Sigma Delta.

WHEREAS, the Supreme Ruler of the Universe has taken to Himself Milton Tate Watson, and

WHEREAS, the American Society of Orthodontists has suffered an irreparable loss, therefore be it hereby

Resolved That this resolution become a part of the minutes of the Society.

Richard Summa

Richard Summa, one of the organizers of this Society, passed away very suddenly in St. Louis on April 8, 1933.

Dr. Summa was born in Germany and was brought to St. Louis by his parents when he was nine years old. There he received his early education. He was graduated from the College of Dentistry of the University of Iowa in 1890. He practiced in St. Louis until 1915. About 1900 he entered the Angle School of Orthodontia, and was graduated in one of the first classes. For several years thereafter he assisted Dr. Angle in the school and was very active in the development of orthodontia from 1900 to 1910. In 1915 he was made professor of orthodontia and prosthetic dentistry in the State University of Iowa College of Dentistry. During the past several years Dr. Summa had not been engaged in practice, but in the immediate past two or three years he had rejoined the ranks in orthodontia and had recently written an outline for a new book on the subject.

WHEREFORE, because the passing of Dr. Summa has been a grievous and irreparable loss, be it hereby

Resolved That this resolution become a part of the minutes of this Society.

Samuel Wilbur Fahrney

It is with deep sorrow that we record the death of Samuel Wilbur Fahrney which occurred suddenly August 12, 1932.

Dr. Fahrney was born in Oregon, Illinois, in 1878. He came to Chicago in 1897 to matriculate in the Chicago College of Dental Surgery, from which institution he received his dental degree in 1901. In 1906 he became a member of the Chicago Dental Society through the West Suburban Branch. He belonged to the Illinois State Dental Society and the American Dental Association. Life membership in the state Society was conferred upon Dr. Fahrney in 1931. For a number of years past he had been a member of this Society. In addition to his professional affiliations, Dr. Fahrney was a Shriner and a member of I. O. O. F.

WHEREAS the profession and this Society have suffered the loss of a valuable and loyal member, be it hereby

Resolved That this resolution become a part of the minutes of the Society.

HENRY C. FERRIS,
B. FRANK GRAY,
FREDERIC E. HABERLE, Chairman.

REPORT OF COMMITTEE ON INTER-RELATIONS

I received a letter about the next Congress in November of 1932 from Dr. Bliss of Toronto, stating that at a recent meeting of the local Orthodontic Study Club the meeting place of the Third Congress was discussed, and it was decided they would make no request for the meeting in Toronto. I answered that letter, and also received a letter from Dr. Vernon Fisk who confirmed their desires. In April of 1933 I received a letter from Dr. G. Maxwell Stevens at quite some length, stating that the ad interim officers, who had the authority for the Second Congress, or after the Second Congress in London, England, were wishing to exercise their authority by making such recommendations as would seem logical. In that letter he enclosed several questions to be answered.

1. Should the Third International Orthodontic Congress be held in 1936?
2. If so, in Europe or in America?
3. If in America, would it interfere with the International Dental Congress in Europe?
4. If in America, what city?
5. If in Europe, in what city, or should it be postponed until 1937 or later?
6. If so, where should it be held?

Before putting these questions to the governing committee as a whole, they would express appreciation if we men in this country would give them some opinions. I can very quickly read the letter in reply to that.

"Dear Dr. Stevens: Received your letter of the twenty-fourth concerning the Third Congress. Last week I had a chance to discuss your questions very thoroughly with Drs. Leuman M. Waugh and Frank Casto of Cleveland, who fortunately were here at the time. Dr. MacLeod has been in New York for the past few days.

"Drs. Waugh, Lourie Porter, George Callaway, and myself had lunch with him to consider further the questions, with the aid of his views and suggestions. We all quite well agreed that so far as the International Dental Congress and the International Orthodontic Congress were concerned, we would not want any conflict which would affect either one or the other and cause a disturbance of date or place of meeting. We are all quite well agreed that the destinies of these two meetings cannot be run parallel indefinitely and have the best interests of both served."

Question 1: Should the Third Congress be held in 1936? The answer we gave was that we would prefer your opinion in the main. We can be ready in 1936, 1937, or later.

The second question was: If so, should we hold the meeting either in Europe or in America? I may say that it was finally agreed, by a process of elimination, that the Third Congress should be held in an English speaking country, and that it should preferably be held this side of the Atlantic.

We men in New York expressed our willingness to have the meeting. We voted for the Third Congress to be held in Boston or New York, with the idea that we men in the East would combine our local resources, and all you men over the United States and Canada would lend your resources in a similar manner.

There was the question of conflict with the next International Dental Congress, which I believe is to be held in Vienna in 1936. We have decided there was no use thinking of the fact that any men going from America would not go there, and would not interfere with the traveling of men from this country if the dates were set close together.

The concourse of events and sequence of correspondence have brought a decision from the men in Europe by a vote of the officers empowered to do it, twenty-nine out of thirty-one, that the meeting should be held in Montreal, and they have set the year for 1937. Dr. Grieve's name appears through this correspondence frequently, and I have a night letter from Dr. McClelland who confirms and endorses the fact that the meeting place should be Montreal in contrast to Toronto as a port of entry. Instead of having to make a train trip, men could come here and land right in Montreal and not go to Toronto.

The Canadians are not contemplating a meeting of their society for a year and a half, and we are not going to hold another meeting for a year and a half.

There are two principal things to present for your consideration. One is the approval of Montreal as the meeting place, selected by the men overseas who have requested it. The next would be the year of the meeting, and I would like to suggest the consideration of 1938 rather than 1937 for reasons which we can all discuss later.

I do not know what the Constitution and By-laws or rules are, but they request, so far as the new organization is concerned, some instruction or information. It seems there has to be a new President General and a new staff of men created spontaneously, particularly after the report of the American Society of Orthodontists.

Those are the principal things: Place of meeting, time of meeting, and any such approval as the American Society of Orthodontists wishes to present.

JOSEPH D. EBY, Chairman.
LLOYD LOURIE,
WILLIAM E. FLESHER,
JOHN V. MERSHON,
W. W. WOODBURY.

REPORT OF BUDGET COMMITTEE

The proposed budget from November 10, 1933, to December 31, 1935:

Essayists and clinicians	$1,000
Local arrangements	100
Reporting	600
Clinics	150
Exhibits (scientific)	200
Printing (including programs)	700
Incidentals	750
Program Committee	300
Executive Council	250
Honorarium (Secretary-Treasurer)	500
Contingent fund	750
	$5,300

Estimated Income

Dues	$4,000
Interest	500
Membership fees	500
Registered guests	1,500
Exhibits	500
	$7,000

The Executive Council recommends that $1,000 additional be used for program purposes, provided the income from guests, manufacturers and special contributions be sufficient to cover this additional amount.

(Signed) CHARLES R. BAKER,
ERNEST N. BACH.

DEPARTMENT OF
DENTISTRY FOR CHILDREN

UNIVERSAL DENTAL CARE FOR CHILDREN*

HARRY STRUSSER, D.D.S., NEW YORK, N. Y.

COMPLETE dental care for children is a comparatively new thought in the annals of dental history. The Society for the Promotion of Dentistry for Children has accomplished much in a short space of time and has awakened both the dental profession and the dental schools of learning to their duty to the children. We have seen many changes in the curriculums of the schools. We have also seen many dental programs inaugurated in cities, counties, state health and education departments and by dental societies. Just as there has been a change in the social and economic world, a gradual change directed from individual to communal betterment, so there has been a change in the professional field.

When we survey the dental field, we find a great many changes. Where the literature and journals did not formerly consider economics, they now are devoting a great amount of space to the subject. In fact, many periodicals are devoted to no other subject. Even the subject of dental economics itself has assumed a different coat. At its inception it was a matter of considering reduced overhead, and cost, methods of office practice, short cuts, and higher fees; today it is the consideration not only of supply and demand for dental care but also of the needs of the community and the ability to pay for its needs.

Changes in dental practice and dental care, the community needs, the health of the community, dentistry for the group with low incomes, Bureau of Extension of Dental Service, free care for children in private offices, all are considered. Recently in addition we have heard and taken part in such discussions as compulsory health insurance, voluntary group insurance, emergency work relief for dentists, state dentistry, and the tendency toward socialization.

In considering complete and applicable health service, we must apply modern dental standards and advances, and yet render that service inexpensively annually. To be able to do so, one must divide the dental patients into three distinct classes.

Reparative and conservative dentistry on a systematic basis has been pointed out as the only solution (I include the application of the present knowledge of diet and nutrition, and the practice of home care). Restorative

*Presented before the New York Chapter of the Society for the Promotion of Dentistry for Children.

dentistry is extremely expensive, and on that premise the future policy must be one of systematic and regular dental preventive care.

Community programs, I have previously stated, must consider primarily "long distance planning." No program of any nature should be started without certain sufficient future financial support. We are familiar with various programs that have been begun by mothers' clubs that were entirely dispensed with and lost because of lack of funds to continue, while others were taken over by philanthropic or public agencies. A small program gradually extended as funds become available is in my opinion more desirable than an initial large program carried on falteringly and eventually collapsing through lack of funds.

Dentally speaking, analysis of the average community discloses three distinct classes which must be included in a comprehensive health program. Generally they are (1) all children, (2) a few fortunate adults, who have maintained a good set of teeth and need only reparative or conservative treatment, and (3) adults drastically in need of radical restorative treatment.

In our discussion I shall treat only of group 1, as I believe that systematic universal dental care of school children will eventually eliminate group 3, and so enable group 2 to provide for itself dental care on annual basis without great difficulty and inconvenience. Even under existing circumstances and conditions, with careful planning, and properly allocated expenditures, universal systematic dental care can be organized and operated successfully and efficiently within a short space of time.

My reason for adopting school children of kindergarten age as the beginning is that the child comes under the control of the school system. It would be by far more economical and desirable to obtain supervision of that child at two years of age. My present plans include such a service at the health centers. It has been shown statistically that there is an increase of about 50 per cent in the children suffering from dental decay at the age of two and six years and also an increase in the number of cavities per child. Dr. McCall's figures (Study made at the M. and L. Guggenheim Dental Clinic.):

2 years 34 children	59% cavities	32% 1-6 cavities	27% 7-17 cavities
3 years 151 children	83% cavities	42% 1-6 cavities	41% 7-20 cavities
4 years 361 children	91% cavities	36% 1-6 cavities	55% 7-31 cavities

Economic conditions do not permit most families to give their children the necessary dental care. As pointed out in the report of the Committee on the Cost of Medical Care, the annual expenditure for dental care is extremely low among the 90 per cent of the families with incomes under $5,000. Among families with incomes of from $1,200 to $2,000, constituting 35 per cent of the population, the average annual expenditure per family is $9.01. Families with incomes of from $2,000 to $3,000 spend an average of $16.39 for dental care. Although $445,000,000 is spent annually for dental service, 60 per cent of this amount comes from 25 per cent of the population while 75 per cent of the population pays only 40 per cent of the national dental bill. This may be interpreted to mean that 75 per cent of the population does not and cannot

obtain adequate dental care under the existing order. This low income group spends $178,000,000 which is less than $2.00 per annum for each of the 90,000,000 people, basing our estimates on 120,000,000 population.

Let us consider another interesting study which was published in the *New York Journal of Dentistry* (February issue), one which pictures graphically the dental conditions and needs of 1,000 patients of the so-called "white collar class."

SUMMARY 1,000 CASES ON FILE AT T. E. R. A. DENTAL CLINIC

(Heckscher Evening Session)

Number of patients with decayed teeth	889
Number of decayed teeth	4,292
Number of carious cavities	4,682
Number of patients with teeth previously extracted	869
Number of teeth previously extracted	5,437
Number of teeth missing	3,725
Number of teeth replaced	1,712
Number of patients with teeth to be extracted	427
Number of teeth to be extracted	1,140
Number of patients with no restorations present, teeth missing to be extracted	604
Number of patients with incomplete restoration, teeth missing to be extracted	256
Number of patients requiring no restorations*	140

DENTAL NEEDS OF AVERAGE ADULTS

I am quoting from the unpublished report of the Committee on Community Dental Service of the N. Y. T. B. & H.: "The average individual among these 1,000 white collar patients presenting himself for dental treatment has four decayed teeth with five carious cavities. (No record of teeth previously filled was kept.) He has had six teeth extracted and looks forward to the immediate extraction of one more. Of the teeth previously extracted, two were replaced and four are missing. Thus this composite person, aged thirty-one years, has eleven of his teeth involved in disease not counting fillings already placed, in other words more than one-third of his natural dentition is involved—28 per cent of his teeth are decayed, missing without replacements or must be extracted now.

"You must consider that these patients had enjoyed some dental care, as some had extensive and expensive dental service. These figures are startling because it is probably average for the adult population; only 11 per cent had no decayed teeth, but some of these are edentulous; only 9 per cent have all teeth present and none to be extracted.

"Let us follow through the twenty-five- to twenty-nine-year age group, in this study the largest numerical group represented, constituting 19.5 per cent of the 1,000 cases examined. About one-fifth among these young adults, 89 per cent have six decayed cavities in five teeth each. Out of a total of 626 teeth previously extracted only 148, or 23.5 per cent, have been replaced. And

*No teeth missing, none to be extracted. Of the 140 requiring no restoration, 49 are reported as having restorations completed at the clinic.

these people were of self-supporting age before depression and also at the age where appearance is considered of vital importance even if health is a secondary consideration.''

COST OF SUPPLYING TEETH

It is quite difficult to ascertain cost of service. This is so changeable because consideration must be given to the sections of the city, the type of people, income, and type of service. Let us consider these costs in a self-supporting pay clinic, properly supervised, and where accurate records have been kept.

Applying the fees of that clinic to the average patient previously noted:

Prophylaxis and examination x-ray pictures	$ 5.50
5 carious cavities assuming 3 small cavities at $2.00	
2 large cavities at 3.00	12.00
Extraction	1.50

Now five teeth must be replaced. We mentioned before that two are replaced, and we are assuming that they remain. Let us assume that they may be replaced by a mandibular lingual bar case and a Nesbitt vulcanite bridge.

Cost of lingual bar $40.00 Bridge $25.00. Total cost is $84.00.

It has been estimated that in most of our private practices (rank and file) these costs would probably rise to $100.00.

Our paramount desire is to increase the health of the people and to provide a fundamental service for children. With the facts previously stated, and the necessity of providing a conservative and inexpensive service—a full complement of teeth for carrying out the function, intended by nature—I propose the following plan for universal dental care.

RESULT OF STUDY AND SURVEY

Some time ago, while making a study and survey of clinical facilities and modes of operation (which included a study of child and adult clinics in Germany and Austria), I found that it takes about forty minutes for a dental hygienist to give a child of school age instruction in brushing the teeth, prophylaxis and examination, and that it takes the dentist three hours (average) for the completion of all necessary dental operative procedures. Using the above figures as a basis for the computation, it would take 833,333 hours of dental hygienists' service and 3,750,000 hours of dental service to care for the 1,250,000 children attending school in New York City. Therefore, it would be necessary to employ 420 dental hygienists on a basis of 2,000 hours per annum for one treatment and 840 dental hygienists for two treatments per child per annum, and 2,500 dentists on a basis of 1,500 hours per annum. (It is suggested, however, that this time be divided to give each dentist not more than three hours at the chair, and therefore 5,000 dentists will be needed—the hours of employment to be from 9 to 12 A.M. and 1:30 to 4:30 P.M. Such an arrangement would permit all dental operations to be performed in perfect daylight nine months out of every year and distribute the service among a larger number of dentists.)

COST OF SERVICE

Dental Hygienists' Service.—Eight hundred and forty dental hygienists at $1,500 per annum gives us a total of $1,260,000 or a little over one dollar per annum per child (for two treatments) exclusive of materials, supplies, instruments and portable equipment. It is proposed to render this service in the school buildings, use whatever equipment is present and portable equipment to supply the additional. The cost of materials, supplies, instruments and equipment will be $100 per annum per hygienist, making a total of $84,000; the grand total would be $1,344,000 (exactly $1.0752 per child per annum for two treatments).

Dental Service.—Five thousand dentists at $1,500 per annum would be $7,500,000. This is exclusive of materials, supplies repairs, maintenance, equipment, clerical help, and supervision. To offset the cost of equipment, repairs, and maintenance, I propose that the offices and equipment of dentists in the immediate vicinity of the public schools be used and a standard quantity of supplies be furnished to each operator. From past experiences in clinic practice, it is estimated that the cost of supplies would be $750,000, and therefore this service would cost $8,250,000.

Supervision.—Supervision is very important when dealing with such an immense problem and also because of the statutory requirements that dental hygienists must be under the supervision of dentists. Supervision of the above mentioned staff would therefore require about 240 dentists at the rate of $2,000 per annum, a total of $480,000. Thus, we see that the total cost of this service (excluding all clerical help, printing of forms, records, office furniture and other incidentals such as materials for health education program, rent for quarters, light, heat, telephone) would be:

Dental hygienists	$ 1,260,000	
Supplies, materials and equipment for dental hygienists	84,000	
Dentists	7,500,000	
Supervision	480,000	
Supplies for dentists	750,000	
Total	$10,074,000	or $8.0592 per child per annum

It is interesting to note that the service to 1,250,000 school children of this city can be rendered at the rate of ten dollars per child per annum. This amount would permit an elaborate program of prenatal and preschool health education, pamphlets, posters, booklets, newspaper publicity, films, or other means of reaching the public and cover all necessary expenses mentioned or other incidentals not mentioned (such as a preventive orthodontic treatment and roentgenographs).

This expense will be reduced annually as the systematic preventive service continues. After the first two years, the expense would be reduced by 50 per cent. These figures may seem high, but if we consider that this preventive service will check and control dental caries, the most common disease of childhood, most prevalent between the ages of eight and ten years (95 to 97 per cent

suffering from bad teeth), the cause of infections of the oral tissues, one of the leading causes of absence from school, we will find that the benefits to be derived will far surpass the expense involved.

DEDUCTIONS

I have reached definite conclusions as to the marked effects which this service will have and it may solve some of the problems presented and outlined by the Committee on the Cost of Medical Care. In the first place, it is not the cost of medical or dental care that we should consider but the distribution of such service. By examining the charts in the Wilbur Committee Report, we find that those in comfortable circumstances or the rich obtain all necessary dental care needed; the poor get what is offered to them at the clinics and hospitals; the middle class and white collar class (which is the majority of our population) is the sufferer. The white collar man (or family) can neither qualify as a patient in the clinic nor can he afford to pay the price of the practitioner, and, therefore, he either neglects his condition or goes into debt as a result of having the work done.

The plan outlined will tend to give employment to the professional man, insure a definite income and at the same time use his available but not productive hours to advantage, reducing his overhead and offering him an opportunity to serve the public at a lower rate or within the means of the average person. There will be no necessity of "soaking" the rich or the small clientele served. (Only 20 per cent of the population ever obtained dental service.) I believe the adjustment will be such that a majority of the 80 per cent will be given an opportunity to care for their dental needs. Even this service would eventually become one of systematic prevention rather than restorative and curative.

EFFECT OF CARIES

It has often been stated that the correction of dental defects has improved scholastic records and has reduced the number of retarded cases, "left-backs" and absenteeism. (Dr. Fones of Bridgeport and Dr. Willis A. Sutton of Atlanta.) If this is true, the cost of reeducation of such pupils will offset the cost (in part) of the proposed program of dental care. I have been informed that the cost of education per child per annum in the elementary school is $105.11; in the high school about $161.95. In many states, education is subsidized. The local boards will benefit by the increased attendance records, thus reducing the cost of the dental program to the community. (See Exhibit A.)

This service will also decrease absenteeism which may result in constant truancy due to the inability to keep pace with the rest of the class. We know that a toothache will disturb the composure of a child and render him unable to master the principles or lessons taught. Truancy may lead and in many cases has led to bad associations. In the past, we have seen associations with dope peddlers and other dregs of society. The plentiful supply of money, at that early age, attracts many an innocent boy or girl into the whirlpool of social degenerates. Here, again, the tremendous cost of rendering justice, the

penitentiary and its concomitants will be reduced. This, too, will offset the cost of the dental program.

This service would make the coming generation more fit. The function of the oral cavity would be maintained since no teeth would be lost (except through accident or unforeseen circumstances), thus reducing the cost of dental care especially in the field of prosthesis. Teeth would remain vital and be ruled out as foci of infection in dealing with systemic diseases. (Dr. Mayo has said that the oral cavity is the cause of from 60 to 70 per cent of systemic diseases.) If this regular dental service is rendered, I am sure that the incidence of systemic diseases as well as the cost of the treatment of these diseases would be materially reduced.

The health of the youth would be maintained, and his value to the community would be greatly increased. "The wealth of a nation is the health of its people."

THE WORKING PLAN

The working plan is not difficult to carry out if the man chosen to carry out these details has been following the trend of the times. The communities or the cities can be divided into sections. In some cities, each section is known by a name. For example in New York, we have Harlem, Greenpoint, Bedford, Brownsville, Yorkville, Mott Haven, Williamsburg. Each particular section has its own varied population, and a study of the sections is necessary before attempting to build up and put into practice the ideal. It is also essential to have a clear understanding and knowledge of the economic conditions of the respective sections. For example, in some very fine localities of well-to-do people it would not be necessary to fulfill all dental operations. Perhaps it would be necessary to do only prophylaxis, examination, charting, and give instruction in diet and home care. Then, the cases can be referred to the family dentist to have the work done. This being established and a central operating office set up, it would be necessary to make a study of the schools in the neighborhood, parochial and public schools, registration, infant birth, and infant death. The latter two items are necessary for the planning of future programs.

Using the statistics and records as a basis, one can determine the amount of professional help that would be needed to carry on this service in the locality. The choice of dentists can be made after civil service examination as to professional ability and suitability of office for this service. The choice of dental hygienists can be made by civil service examination. It is my opinion that this type of service would tend to stimulate a better type of office with a dental assistant in attendance. It would also stimulate an activity to keep in touch with modern trends.

This will have an effect upon the future locations of dental practitioners. There are a great many localities where dentists are needed but are not available, while other localities have a surplus of service with no need for it. This controlling arrangement will supply the need, and with proper cooperation and coordination new men would be guided into proper locations. Thus, not only the practice of dentistry and the public would be benefited, but also the practitioner.

These men and women dentists and hygienists would be instructed in the handling of the child, children's practice, and the use of standard forms and procedures. When the preliminary set-up and study are accomplished, the actual work can be started. The needs of the school are ascertained, *the dental hygienists set up in the schools,* the necessary *dentists in the immediate vicinity of a school set up and instructed,* then everything is ready for the patients.

Perhaps, I can visualize these various steps a bit clearer because I have been in this type of service practically every day of my professional life. With all of the details and fine points worked out, there will be instituted a systematic preventive service.

In New York City, we are fortunate in having all the statistics mentioned.

Thus, you can picture the plan I have in mind and which I propose to you as the forerunner of the slogan, "Sound Teeth for Every Child."

EXHIBIT A

The following figures are taken from a study of the data found in the Bulletin of the United States Public Health Service—"The School Child." (Bulletin No. 200.)

The figures are based on 1,250,000 children.

Class A			
Page 13—Table 6			
Number of days lost per annum per 1,000 for toothache		157	196,260
Number of days lost per annum per 1,000 for other conditions of teeth		29	36,260
	Days lost		232,500
Class B			
Table on page 13			
Digestive diseases, case rate per 1,000—238.8 school days lost		411	513,750
Headache diseases, case rate per 1,000—298.2 school days lost		319	398,750
Neuralgia diseases, case rate per 1,000— 6.2 school days lost		14	17,500
			930,000
Cervical adenitis	6.2	31	38,750
			968,750
Class C			
Colds case rate per 1,000 727.3 school days lost per 1,000 children		1,696	2,140,000
Influenza and grip 110.0 school days lost per 1,000 children		630	787,500
Tonsillitis and sore throat 232.8 school days lost per 1,000 children		625	781,250
			3,708,750
Stiff neck, days lost per 1,000		9	11,250
Heart condition, days lost per 1,000		27	33,750
Earache, days lost per 1,000		24	92,500
			137,500
Total number of days involved	3,708,750		
	968,750		
	232,500		
	137,500		
	5,047,500		

If we reduce the days absent in any community, there will be an increase in funds received from the state. This would pay part of expenses incurred by the dental program. Example, New York City Board of Education receives about 30 cents per day per child in attendance from New York State. If we

reduce the number of days absent only 50 per cent, we would add more than 2,500,000 days to the school record and thereby add to the local receipts over $750,000 with no additional expense for teaching facilities. Another item to take into consideration is the one of nonpromotions. In New York City the average is a little over 6 per cent. In some school districts it reaches 9½ per cent. The reduction in dental and physical or systemic defects will greatly reduce the percentage of nonpromotions or left-backs. This will reduce the cost of reeducation. For example:

Registration	1,250,000	Children, average
	×.06	Average left back per annum
	75,000	
	$105.11	Cost for education per child per annum
	$7,883,250	(If based on the high school cost of $161.96, the cost of reeduction is much greater.)

If these figures are reduced only 50 per cent, there still is a great saving.

It has also been stated by the late Dr. S. W. A. Franken that a clean oral cavity reduces postoperative (general anesthesia) complications and increases rapidity of recovery. If this reduction of hospital days per patient is but one day, we reduce the cost of treatment per case (average) $5.00. A reduction of one million hospital days means a saving of $5,000,000, and a more satisfied patient and a happier family.

REFERENCES

Dental Health for the Community, unpublished report.
Community Dental Service Committee, N. Y. T. B. & H.
Medical Care for the American People, report of the Wilbur Committee.
Wynne, S. W.: The Status of School Dental Clinics in New York City, Dental Items of Interest, May, 1933.
Strusser, H.: Universal Dental Care, unpublished.
Communication from Dr. H. Strusser, Chief of the Dental Division of the Department of Health, New York City, Dental Items of Interest, May, 1933.
The Problem of the Public School Dental Clinic, editorial, Dental Items of Interest, May, 1933.
The Study of One Thousand Cases, N. Y. J. Dent. pp. 46-48, February, 1934.
The School Child, Bulletin No. 200, U. S. P. H. S.

UNERUPTED MOLAR AND PREMOLAR TYPE OF FUNCTIONAL SPACE RETAINER

Case Report

Floyde Eddy Hogeboom, D.D.S., Los Angeles, Calif.
Professor of Children's Dentistry, College of Dentistry, University of Southern California

THERE are cases in which early loss of deciduous molars calls for some special form of space retainer. The case which I am reporting is an example of neglected health and no dental care with the usual sequelae. The patient, a boy, was about four years old, and his mouth presented every type

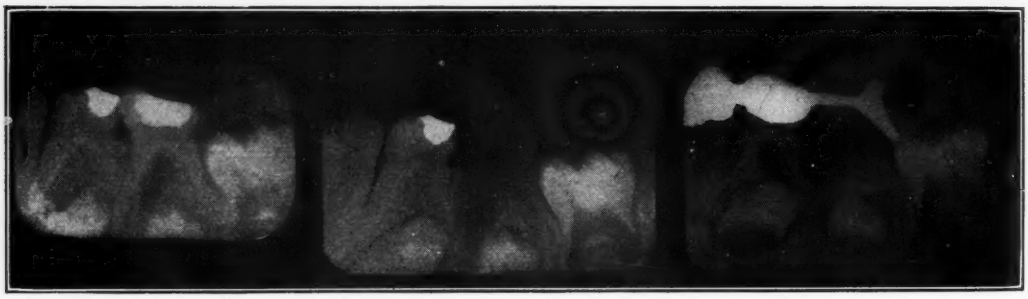


Fig. 1. Fig. 2. Fig. 3.

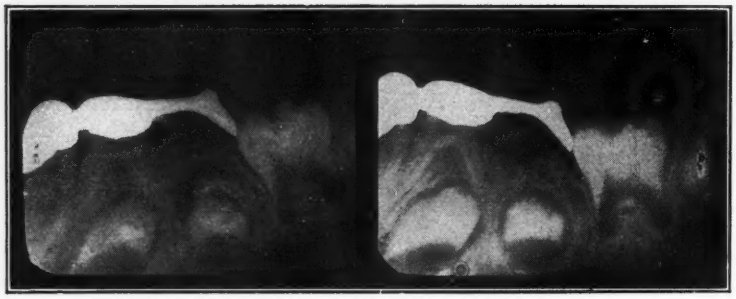


Fig. 4. Fig. 5.

and degree of caries. The mandibular right second deciduous molar was putrescent, and an attempt was made to treat and save the tooth. Because of his lowered vitality and poor resistance the treatments failed, and it was necessary to extract the tooth. The x-ray pictures show the steps in the treatment of this condition.

Fig. 1 shows the second deciduous molar badly abscessed (Feb. 28, 1933).

Fig. 2 shows the second deciduous molar extracted.

Fig. 3 shows the space retainer in place on the teeth, but not cemented. This x-ray picture was taken to check the position of the "shoe."

The following is the technic used in the construction of the space retainer: Take a copper band and make a compound impression of the deciduous canine and the deciduous first molar. Make amalgam dies of the impressions. Then on these dies make wax crowns with thin gold wax. Invest these in cristobalite investment and cast. The crowns are then adjusted to the amalgam dies and polished. Place them on the teeth in the mouth and take a compound impression of that side of the jaw. Run this impression in a hard stone. With the crowns on the stone model a wax bar is molded, using the x-ray picture of the extracted tooth for measurement. Some carving of the stone model will be necessary over the erupting tooth for an approximate fit. The bar is cast in a hard gold and soldered to the crowns. The two crowns are soldered together at this time also. Adjust the space retainer in the mouth. This step is shown in Fig. 3.

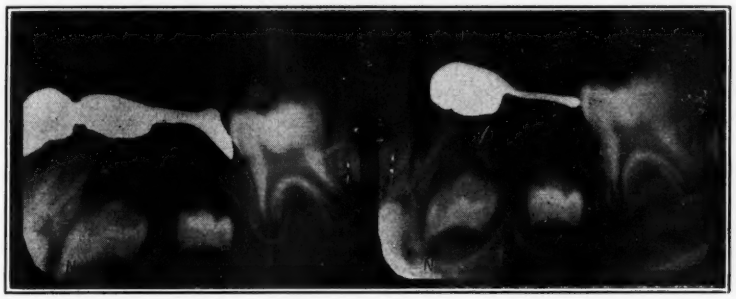


Fig. 6. Fig. 7.

Fig. 4, the adjustment having been made, the retainer is cemented to place (April 13, 1933).

Fig. 5, two months later. The x-ray picture shows the first permanent molar erupting.

Fig. 6, ten months later (April 16, 1934), shows the first permanent molar erupted. It was necessary at this time to change the functional space retainer to another type because the shoe was impinging on the bone forming around the first permanent molar.

Fig. 7 shows the type of retainer we advocate in this position with a full crown on the first deciduous molar and a bar with a ball on it bearing on the first permanent molar.

This case, of course, is not the ordinary type, but the results were very satisfactory and the forming second premolar will have ample space in which to erupt correctly.

REFERENCE

Hogeboom, Floyde Eddy: Practical Pedodontia, St. Louis, ed. 3, pp. 194 and 195, The C. V. Mosby Co.

THE FORM AND DIMENSIONS OF THE PALATE IN THE NEWBORN*

M. F. Ashley-Montagu, Ph.D., New York, N. Y.

(Continued from page 704, July)

Although the purpose of this study is mainly mensurative, it would not be out of place here to say something of the developmental significance of the grooves and sulci just mentioned.

Cecil West,[8] who has made an exemplary study of the development of the gums on the human fetus, has clearly demonstrated that the gums may be considered to develop in two distinct parts, a labiobuccal and a lingual portion. The labiobuccal portion is the first to develop and may be recognized as early as the seventh week, it tends to grow in a vertical direction from

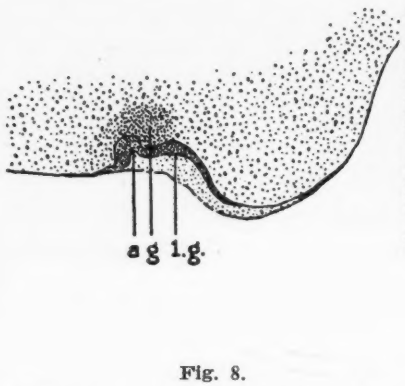


Fig. 8.

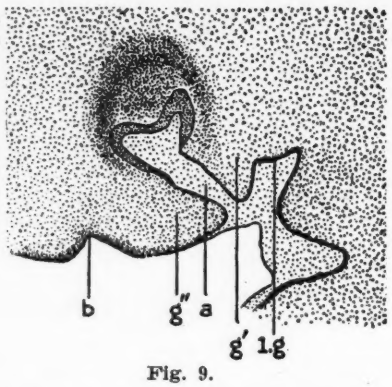


Fig. 9.

Fig. 8.—Sagittal section through incisor region of maxilla of an embryo seven weeks and four days old, after West, showing (*l. g.*) lip groove, (*a*) dental groove, and (*g*) primitive gum.

Fig. 9.—Coronal section through maxilla of a fetus nine weeks and two days old, showing (*l. g.*) lip groove, (*a*) dental groove, (*b*) gingival groove, (*g'*) the labiobuccal, and (*g''*) the lingual portions of the gum.

above downward in the case of the palate, while the lingual portion grows more in the horizontal plane in an anteroposterior direction. For this reason the labiobuccal portion of the gum appears to be more prominent than the lingual portion; actually there is no difference in the growth rates between the two.

If we examine the jaw of a thirty-two-day-old embryo, we find that its outermost edge is marked by two slight parallel grooves. The more external and the shallower of these grooves is the lip groove (Fig. 8, *l. g.*), which as development proceeds will gradually deepen and ultimately will limit the buccal surface of the gum and separate it from lips and cheek. The narrower, deeper, and more medial groove is the dental groove (*a*) "which, growing into

*Department of Anatomy, and Division of Child Research, College of Dentistry, New York University.

the mesenchyme of the jaw will give rise to the enamel of the teeth. The labiobuccal portion of the gum is the tissue (*g*) inclosed between these two grooves, and at this stage there is no differentiation of the lingual portion of the gum from the surrounding parts. Such differentiation may be seen, however, in a coronal section through the molar region of the jaw of a fetus of 35.5 mm. (Fig. 8), in which the two parts of the gum are limited by three grooves: the labial groove (*l. g.*), the dental groove (*a*), and a third, which we may call the gingival groove (*b*). Thus, the labiobuccal portion of the gum (*g'*) is that which lies between the labial and dental grooves, while the lingual portion is that between the dental and gingival grooves (*g''*)'' (West, loc. cit.). (Fig. 9.)

At birth these grooves are still apparent, but with the eruption of the teeth they disappear. Their appearance at birth is shown in Fig. 11 taken from West. The dental groove (*a*) is the groove which separates the labiobuccal

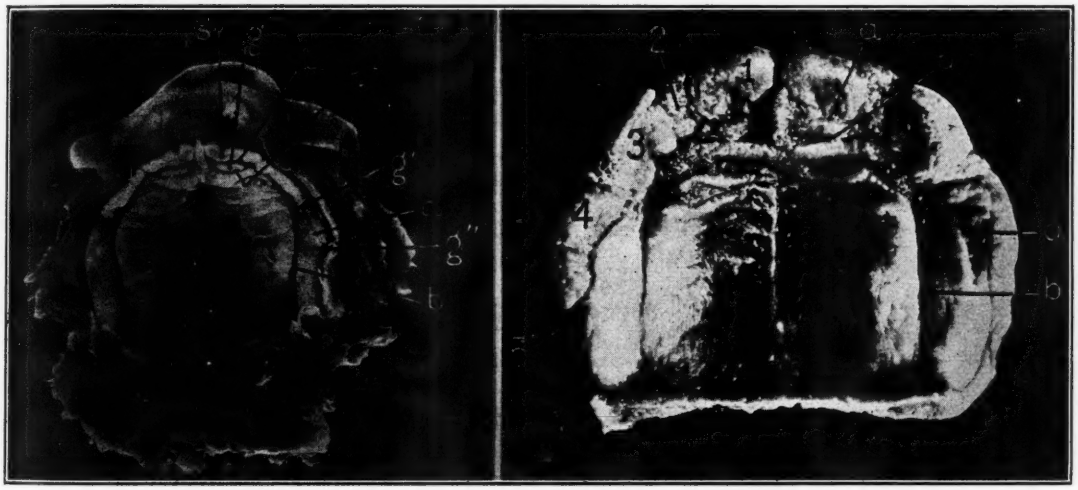


Fig. 10. **Fig. 11.**

Fig. 10.—Gums and palate of a fetus eighteen weeks old, after West, showing (*a*) dental groove, (*b*) gingival groove, (*g'*) labiobuccal portion, and (*g''*) lingual portion of the gum.

Fig. 11.—Gums and palate of a fetus twenty-nine weeks old, after West, substantially representing conditions as seen in the newborn. (*a*) Dental groove, (*b*) gingival groove; (1) medial incisor segment, (2) lateral incisor segment, (3) canine segment, (4) first molar segment, (5) second molar segment.

from the lingual portions of the developing gum. The gingival groove (*b*) is equivalent to our gingivopalatine groove.

Viewed from below the dental groove is continuous with the incisive sulci which lie one on each side of the incisive papilla; these sulci together with the papilla traverse the buccal and lingual portions of the gingivum in this region, and by its association with these sulci the dental groove may be said to become continuous with the vestibule of the mouth anteriorly and with the gingival groove posteriorly, for the gingival groove separated by the right-angled triangular *pars lingualis* of the gum from the labiobuccal portion lies posteriorly running transversely upon the palate to about a point opposite the anterolateral sulcus or the sulcus between the canine and first premolar segments of the gum (see Fig. 10). At this point the dental and

gingival grooves of the incisor and molar regions meet, the gingival groove continuing to run posteriorly directly backward while the dental groove, which at its anterolateral part is hidden from view by the lateral growth of the anterior rugae, passes obliquely toward the buccal border over the anterior two-thirds of the molar portion of the gum. The molar dental groove corresponds to the posterolateral sulcus.

Anteriorly the teeth erupt through the labiobuccal portion of the gum between the dental groove and the lip groove. Posteriorly the molars erupt, in the case of the first, partly through the lingual and partly through the labiobuccal portions, and in the case of the second, almost entirely through the lingual portion of the gum.

The sulci, grooves, or inflections, upon the surface of the gums, with the exception of the dental grooves, occur entirely upon the labiobuccal portion and divide it into a number of segments equal to the number of deciduous teeth, namely, five. The anterior three segments are generally easily recognizable, the posterior two less so. The sulci which limit the segments of the gum are the *incisive sulcus* situated upon the lateral border of the incisive papilla. The *anterior sulcus* parallel to the latter and forming the distal boundary of the medial incisor; obliquely lateral to this is the *anterolateral sulcus* forming the distal boundary of the lateral incisor and the mesial boundary of the canine; the *lateral sulcus* forms the distal boundary of the canine and the mesial boundary of the first molar.

With these sulci alone we shall be concerned in what follows. The remaining sulcus is excessively difficult to distinguish. When found it is never seen as a completely separative inflection of the gingival surface but merely as a shallow depression upon the lateral surface of the gingivum a slight distance either anterior or posterior to the point at which the posterolateral sulcus crosses the inferior lateral surface of the gingivum. This sulcus, we have determined, constitutes the distal boundary of the first molar and the mesial boundary of the second molar. It will, therefore, be called the *molar sulcus.*

In two dissections of infants and twenty-four of adults it was found that the median palatine raphe invariably corresponded with the course taken by the median palatine suture above.

Thus far we have touched upon the superficial appearance of the palate and some of the landmarks appearing upon it. We may now proceed with the discussion of the measurement of our series of palates.

THE MATERIAL

The material which forms the subject of this report consists of stone casts made from 90 living newborn males, ranging between the ages of birth and thirteen days with an average age of 3.7 days $\sigma \pm 2.8$ days. These casts were made for Dr. Harry Bakwin, assistant professor of pediatrics at University and Bellevue Hospital Medical College, New York City, by an assistant. For permission to examine these casts and for many other kindnesses, grateful acknowledgment is here made to Dr. Bakwin.

The infants, who were all of normal form and structure, were born at Bellevue, they represent the offspring of the poorer classes and represent, too, a rather heterogeneous group of stocks. The parents were with the exception of one case (No. 89, Negro) Caucasians. It was thought inadvisable at this stage of the investigation to attempt to separate the material into racial or national groups, but in our future investigations such a separation, if possible, will be made and the material studied as homogeneous groups with a view to eventual comparative study.

Impressions were taken of the palate in modelling compound, and the positive was poured from these in stone. Unfortunately, the buccal surfaces of the casts were left either very indefinite or had been so chipped and flaked that they could not be used with any degree of security as surfaces in mensuration. The posterior margins of the gingivum which were to supply the limiting points for the posterior boundary of the palate were equally ill defined owing to the quick attenuation of the posterior alveolar process. In this situation, however, the approximate midpoint at which the posterior gingival margin becomes level with the mucous membrane of the postgingival tissues was chosen as the posterior limit of the palate, a point corresponding to the limit of the postalveolar membrane in the macerated condition, and called by us the *postgingivale*. The weak definition of the posterior margins is not a characteristic alone of the casts described herein, but is characteristic also of the most perfectly made casts.

THE METHOD OF MEASUREMENT OF THE PALATE

Owing to the somewhat defective nature of the palates, which displayed itself mainly in the chipped and erased buccal margins, the attenuity of the median raphe, and the extreme indefiniteness of the postgingival region, the method of measurement had to be adapted to this material, but in such a way that it would also serve for more perfect material, the data of which obtained by the same method could eventually be compared without any difficulty. After some experimental trials, a method of measurement was eventually elaborated which adequately fulfilled our needs.

Since the buccal margins of the casts at our disposal were so imperfect, buccal maximum diameters could not be taken, and the buccal alveolar gingival arch had, therefore, to be eliminated from any consideration in the report of these casts. But in the case of perfect casts such an arch could be determined with ease. The only part of the palate that we were forced to forego in making our projections was the buccal alveolar gingival arch. However, the method to be used in the measurement of perfect casts will be described here in its entirety.

From our description of the fleshy palate it will be observed that there are certain morphologic landmarks upon its surface that could be conveniently utilized as ordinate points with respect both to orientation and to measurement. Thus, after a good deal of experimental work it was found

that the position of the lateral sulcus in relation to the incisive point, that is, the point which is represented by the midpoint of the anterior margin of the incisive papilla, was extremely constant. It was found too, that when the palate is oriented upon the incisive and lateral sulcus points, the postgingivale were sometimes brought up to the same plane. However, upon further experiment this was found not to hold good for a number of cases, so that this plane of orientation was abandoned in favor of the more satisfactory one which is determined by the incisive and postgingival points. This plane of orientation, the incisive postgingival plane, we have called the *palatine plane,* and have adopted for use throughout this investigation in making our projections of the palate.

Before orienting the palate certain points were determined in pencil: the incisive point, the anterior points, the anterolateral points, the lateral sulcus

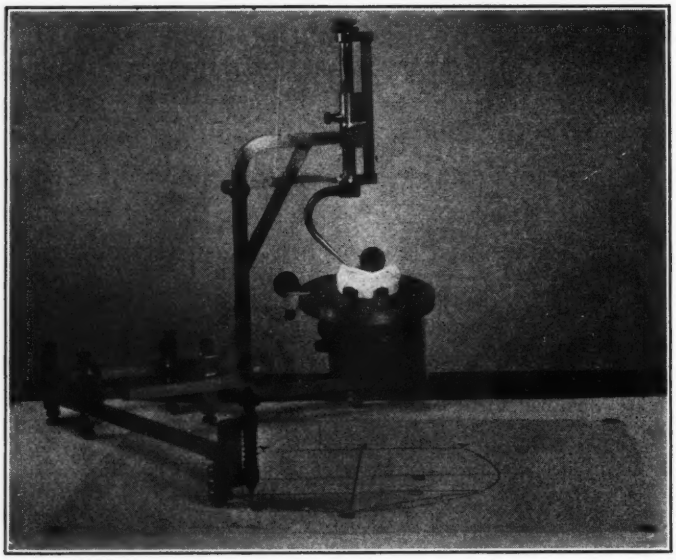


Fig. 12.—The dental pantograph used in making the projections for the present study.

point, the molon point, the posterolateral point, and the postgingivale. With these points clearly marked on both sides, the palate was then oriented upon Stanton's dental pantograph and drawn to an enlarged scale of five times. The dental pantograph of Stanton which is shown in Fig. 12 and has been fully described elsewhere[1] is an instrument upon which it is possible to orient the cast of a plate in a mathematically exact plane, and by its means to project orthographically the points, landmarks, and outlines of a palate to a scale of five times upon a plane surface.

First, the maximum buccal marginal projection is drawn, then the lowermost projection of the gingival process, determined by the incisive, lateral sulcus, molon and postgingivale points, is projected; the points are, of course, registered upon the drawing. The incisive papilla, the median raphe and the gingivopalatine groove are further projected and the palatal height above

the dental surface of the gingivae is determined by reading from the elevation bar of the surveyor on Stanton's pantograph, and its site registered on the drawing.

When the drawing is complete, chords are projected for the various dimensions and loci, as follows:

1. Maximum Palatal Breadth: This is usually found to correspond to the greatest diameter between points slightly posterior to the molon point.

2. Posterior Palatal Breadth: The diameter between both postgingivae.

3. Anterior Palatal Breadth: Diameter between the lateral sulcus points.

4. Maximum Palatal Length: From the incisivum to the posterior breadth chord.

5. Anterior Palatal Length: Incisivum to anterior sulcus breadth chord.

6. Middle Palatal Length: From the point at which the palatal length chord bisects the anterior breadth chord to the corresponding point on the maximum breadth chord.

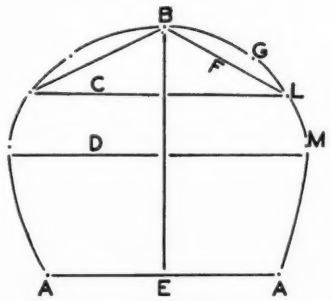


Fig. 13.—A typical projection: *A*, postgingivale; *B*, incisive point; *C*, anterior breadth chord; *D*, maximum breadth chord; *E*, posterior breadth chord; *B-E*, maximum palatal length chord; *F*, chord expressing the distance of the incisive to the lateral sulcus point; *G*, antero-lateral sulcus point; *L*, lateral sulcus point; *M*, molon; *B-C*, anterior palatal length; the dot, lateral to the maximum length chord represents the maximum palatal height point.

7. Posterior Palatal Length: From the point of bisection of the maximum breadth chord by the palatal length chord to the corresponding point on the posterior breadth chord.

8. Palatal Height: Maximum height above the occlusal surface of the gingivae.

9. Locus of Maximum Palatal Height Point: From the incisivum to maximum palatal height point.

10. Distance of maximum palatal height point from palatal length chord.

11. Distance of maximum palatal height point from maximum breadth chord.

12 and 13. Lateral Incisive Chord: Incisivum to anterior sulcus point, right and left.

These chords are then measured upon the projection by means of a rule graduated to read in tenths of millimeters and recorded preferably upon the projected chord itself. (See Fig. 13.)

THE FORM AND DIMENSIONS OF THE PALATE OF THE NEWBORN

The mean general measures of the newborn infants examined for age, body height, sitting height, and nasion prosthion height were as follows:

Age	3.7 days $\sigma \pm 2.8$ days
Body weight	3,315 grams $\sigma \pm 539.5$ grams
Sitting height	332 mm. $\sigma \pm 17.6$ mm.
Nasion prosthion height	31.0 mm. $\sigma \pm 1.4$ mm.

The mean values obtained in the investigation as to the form and dimensions of the newborn palate are given in Table VII.

TABLE VII

THE AVERAGE DIMENSIONS OF THE PALATE IN THE NEWBORN

NUMBER OF CASES FROM WHICH CALCULATED	CHARACTER	AVERAGE VALUE	STANDARD DEVIATION	
78	Age in days	3.7	± 2.8	
90	Body weight in grams	3,315.0	±539.5	
78	Sitting height	332.0	±17.6	
78	Nasion prosthion height	31.0	± 1.4	
82	Anterior palatal breadth	25.5	± 1.5	
90	Maximum palatal breadth	30.6	± 1.5	
90	Posterior palatal breadth	25.5	± 1.2	
90	Maximum palatal length	25.6	± 1.6	
82	Anterior palatal length	6.9	± 2.5	
82	Middle palatal length	7.4	± 2.9	
82	Posterior palatal length	11.3	± 2.8	
90	Distance of maximum palatal breadth chord from incisivum	14.3	± 1.3	
90	Palatal height	7.6	± 2.0	
90	Distance of maximum palatal height point from incisivum	15.1	± 2.1	
82	Distance of lateral sulcus point from incisivum			
	Right side	14.4	± 1.1	
	Left side	14.4	± 1.1	
Indices				*Type*
90	Palatal index	119.9	± 6.7	Brachyuranic
90	Palatal height index	24.8	± 2.3	Tapeinostaphylic
83	Anterior palatal arch index	27.4	± 3.6	Cycloform

The length of the palate was found to be 25.6 mm. $\sigma \pm 1.6$ mm.

The posterior breadth 25.5 mm. $\sigma \pm 1.29$ mm.

The anterior palatal breadth 25.5 mm. $\sigma \pm 1.5$ mm. It will be observed from these measures that the anterior breadth of the palate is equal to the posterior breadth, and that the palatal length is, similarly, almost exactly equal to each of these measures.

The maximum breadth is 30.6 mm. $\sigma \pm 1.51$, that is, some 5 mm. greater than the anterior and posterior breadths, and the length of the palate.

The average palatal index, expressing the relation between the maximum length and the maximum breadth of the palate according to the formula

$$\frac{\text{Maximum palatal breadth} \times 100}{\text{Maximum palatal length}} = \text{Palatal index}$$

is 119.9 mm. $\sigma \pm 6.7$ mm. The palate is, therefore, *brachyuranic.*

The palatal height is 7.6 mm. $\sigma \pm 2.0$ mm. The palatal height index which expresses the relation between the maximum breadth and the maximum height of the palate according to the formula

$$\frac{\text{Maximum palatal height} \times 100}{\text{Maximum palatal breadth}} = \text{Palatal height index}$$

is 24.8 mm. $\sigma \pm 2.3$ mm. This index is below the lowest average index recorded for adult man, this being 26.1 mm. in the case of the Maori Martin Lehrb. Anthrop. 1928, p. 933) but as a variable this index falls well within the lower range of variation for the adult; however, even so the infant palate is *relatively* and absolutely somewhat more flat than the adult palate.

The distance of the locus of the maximum palatal height point from the incisive point was some 15.1 mm. $\sigma \pm 2.10$ mm.

The anterior palatal length is 6.9 mm. $\sigma \pm 2.5$ mm.; the middle palatal length 7.4 mm. $\sigma \pm 2.9$ mm.; the posterior palatal length 11.3 mm. $\sigma \pm 2.8$ mm. The distance of the maximum breadth chord from the incisive point is 14.3 mm. $\sigma \pm 1.36$ mm. The maximum breadth of the palate occurs 1.5 mm. posterior to the midcoronal plane of the palate.

The distance from the incisive point to the lateral sulcus point is the same for both sides, 14.4 mm. $\sigma \pm 1.12$ mm. for the right side, and 14.4 mm. $\sigma \pm 1.10$ mm. for the left side.

It is possible to construct an index which will to some extent express the form of the curvature of the anterior margin of the palate. In order to keep the index at a low figure, we have reversed the usual procedure by multiplying the value for the anterior palatal length by a hundred and dividing it by the value for the anterior palatal breadth, thus

$$\frac{\text{Anterior palatal length} \times 100}{\text{Anterior palatal breadth}}$$

the quotient yields the desired index, i.e., the anterior palatal arch index. The average anterior curvature or arch index is 27.4 mm. $\sigma \pm 3.6$ mm.

The form of the anterior curvature in our cases could be determined accurately in eighty-three instances, in the remaining seven cases the lateral sulcus was so weak that it could not be determined, and, therefore, the anterior breadth chord could not be projected. Five types of curvature were found to prevail. A type in which the anterior curvature is markedly flat or blunt and which is characterized by an index that lies between 20.0 and 23.0. This type we have called *platyform*. Next is an intermediate type, which we have called *mesiform*, the index of which ranges between 23.1 and 26.0; in this type the anterior curvature though not flat does not quite resemble the arc of a circle, it represents a transitional form between the platyform and the dominant cycloform type. In the *cycloform* type, so called because the anterior curvature approximately describes the arc of a circle, the index range is 26.1 to 30.0. In the *propyriform* type the anterior arch is rather sharper than the cycloform arch but not as sharp as the *pyriform* arch. The index range is between 30.1 and 33.0. Finally there is the *pyriform* type, in which the

gingivae at the incisivum tend to approximate to a point, the index range is 33.1 to 37.0. (See Fig. 14.)

TABLE VIII

ANTERIOR PALATAL ARCH FORMS

TYPE	INDEX	NUMBER
Platyform	20.0-23.0	10
Mesiform	23.1-26.0	19
Cycloform	26.1-30.0	33
Propyriform	30.1-33.0	15
Pyriform	33.1-37.0	6
Average cycloform	Average index 27.4 $\sigma \pm 3.6$	Total 83

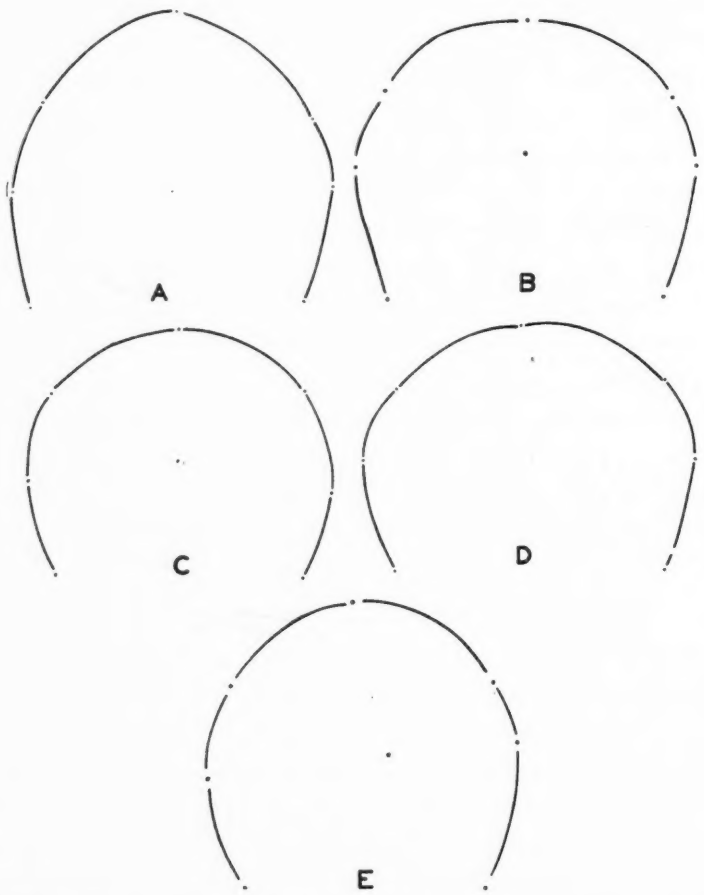


Fig. 14.—Illustrating types of palatal form and anterior arch curvature. *A*, Case 75, dolichouranic 109.8 and pyriform 36.3; *B*, Case 85, brachyuranic 122.8 and mesiform 25.7; *C*, Case 18, brachyuranic 124.2 and cycloform 27.9; *D*, Case 82, hyperbrachyuranic 135.2 and platyform 22.7; *E*, Case 32, mesuranic 112.3 and propyriform 31.8.

We have classified the palatal forms under four types, as follows: the long, or *dolichouranic* with an index between 100.0 and 110.0, the fairly broad or *mesuranic* with an index between 110.0 and 120.0, the very broad, or *brachyuranic,* with an index between 120.0 and 130.0, and the excessively broad, or *hyperbrachyuranic* with an index between 130.1 and 140.0. The distribution of the types is shown in Table IX.

TABLE IX

DISTRIBUTION OF PALATAL TYPES

	INDEX	NUMBER
Dolichouranic	100.0-110.0	8
Mesuranic	110.1-120.0	36
Brachyuranic	120.1-130.0	37
Hyperbrachyuranic	130.1-140.0	2
Total number		83

The relationship between the total palatal form and the anterior palatal arch form is shown in Table X from which it will be seen that there is a very definite tendency for the long palate to exhibit a sharp anterior arch and for the broad palate to have a flatter type of arch. The most general tendency of the palate of the newborn seems to be toward a cycloform anterior arch.

TABLE X

THE RELATIONSHIP BETWEEN THE TOTAL PALATAL FORM AND THE ANTERIOR ARCH CURVATURE

	PLATYFORM	MESIFORM	CYCLOFORM	PROPYRIFORM	PYRIFORM	NUMBER
Dolichouranic			4	1	3	8
Mesuranic	2	6	13	12	3	36
Brachyuranic	6	13	16	2		37
Hyperbrachyuranic	2					2
	10	19	33	15	6	83

DISCUSSION

The literature dealing with the growth of the normal newborn palate is limited. Alkan[2] (1900) was the first investigator to report upon the dimensions of the normal newborn palate, as well as upon the abnormal palate. Unfortunately, Alkan's method of measurement was extremely crude.

Altogether Alkan examined 35 newborn infants, 16 male and 19 female, with an average age of 4.1 days. The values obtained from his data, are palatal breadth 27.0 mm., length 32.0 mm., height 12.0 mm. The palatal index is 84.3 and the palatal height index 22.6. With the exception of the palatal index Alkan's figures differ so considerably from the findings of other investigators (See Table XIII) that in view of these differences and his crude method of measurement they must be completely disregarded.

Alkan measured the width of the palate by introducing the arm of a compass between the lingual alveolar margins, in the adult either between the first and second premolars or the first and second molars, and then measured the distance on an ordinary millimeter rule; in children the measure was taken between the first and second molars in the same way. The length was taken from the middle of the incisors (posteriorly) to the end of the hard palate, this latter point being determined by two small inflections which he found in 80 per cent of cases on either side of the raphe at the junction of the hard and soft palates. This measurement was taken with what is described as an "einfachen Myrthenblattsonde." The blade of this instrument was introduced between the central incisors and pushed forward until it reached the

end of the hard palate, it was then withdrawn and the distance measured upon a rule. This double activity was rendered necessary because the instruments used did not possess a millimeter scale. The height was determined by setting one arm of a compass on the lingual alveolar margin between the second premolar and the first molar, and the other area on the median raphe of the palate. This was done first on the right and then on the left side, the raphe point remaining the same. The compass was then withdrawn and the distance measured on a rule. In the newborn the breadth was taken with the compass at approximately the middle of the inner alveolar margins.

Denzer[3] (1921) studied the height and breadth of the palate in thirty-eight children, presumably of both sexes, under one year of age. Most of the children whose palates were studied were undernourished "foundlings and infants awaiting adoption." Denzer measured casts of the palate by means of an early form of Stanton's dental pantograph. He took the greatest breadth between the central arches of the alveolar process, as we have done, and the height was determined by means of the surveyor and elevation reader on the dental pantograph precisely as we have done.

Only one of Denzer's series, and that one evidently an abnormal case, falls within our age-group series. In this single case the infant was twelve days of age, the maximal palatal breadth 30.0 mm., the length was not taken, the palatal height was 11.3 mm. (!) and the palatal height index 37.0 (!) With the exception of the palatal breadth these figures are so wide of the mark in excess of any obtained by other investigators, and even by Denzer himself for older children, that they must undoubtedly be attributed to an extreme abnormality in the conformation of this palate, and therefore cannot be considered here. Denzer's figures for the rest of his series are very much nearer those of other investigators for the newborn palate, these are given in Table XI. Denzer's conclusion is that the infant's palate is broad and flat when compared to that of the adult.

TABLE XI

AVERAGE DIMENSIONS OF PALATES AT DIFFERENT AGES, AFTER DENZER

AGE	NUMBER CASES	GREATEST WIDTH (AVERAGE), MM.	GREATEST HEIGHT (AVERAGE), MM.	$\frac{\text{HEIGHT}}{\text{WIDTH}}$ INDEX (AVERAGE)
1 to 3 months, inclusive	13	29.4	8.7	28
4 to 6 months, inclusive	12	31.0	9.0	29
7 to 11 months, inclusive	11	32.6	8.5	26
Total average	39	30.9	8.79	28

Franke[4] (1922) has studied the growth of the alveolar arches and to some extent the palate in more than 1,200 skulls of all ages, and in 60 models of normal and abnormal fetuses and newborn infants. There were apparently about 25 newborn babies available for study in the form of palatal casts. These were measured by means of an orthographic projection of Franke's own device into the description of which we need not enter here. Of his method it is only necessary to say that it was sufficiently like our own to render compari-

son of our own measures with the few palatal dimensions he gives for the newborn quite valid. The only palatal dimensions we have been able to gather from Franke's figures are the newborn palatal length which he found to be 26.8 mm. and the anterior palatal breadth (which would be slightly anterior to our own maximum breadth) and which he found to be 31.4 mm. (See his Table I, p. 376[4]; also the excellent summary by Brash.[5])

Katz[6] (1923) in an unpublished thesis (for the loan of which we are greatly indebted to Prof. H. Bluntschli of the Institute of Anatomy of Frankfurt University, Germany) has studied the question of vaulting of the newborn palate in 23 newborn infants. She studied the palate by the method of projection from casts of the palate. She does not give absolute measures but only indices which are shown here in tabular form (Table XII). Katz found that there was a good deal of variation in respect to length, breadth, and height of the newborn palate. She found the newborn palate to be flatter and broader than the adult; she believes that this is due to the undeveloped state of the alveolar process in the newborn; but she adds that the form of the adult palatal vaulting is already to be seen in the newborn *in statu nascendi.*

TABLE XII

NEWBORN PALATAL DIMENSIONS, AFTER PEYTON

CROWN-HEEL LENGTH CM.	AGE IN DAYS	WEIGHT GM.	FRONTO-OCCIPITAL DIAMETER CM.	WIDEST TRANSVERSE DIAMETER OF PALATE CM.	ACTUAL SURFACE WIDTH OF PALATE CM.	HEIGHT OF PALATE CM.	LENGTH OF ALVEOLAR PROCESS CM.
			Males (Normal)				
49.0	2	3,020	11.1	3.00	3.50	0.72	2.90
49.2	1	3,355	12.3	3.20	3.90	0.93	2.98
51.5	4	3,115	11.7	3.27	3.80	0.94	2.70
52.1	14	3,555	12.6	3.30	3.90	0.98	3.25
52.7	0	3,760	11.2	3.40	3.80	0.81	3.17
52.9	6	3,160	12.2	3.40	3.85	0.80	2.98
53.4	5	4,105	12.1	3.45	4.00	0.80	2.90
			Females (Normal)				
45.7	10	2,380	11.1	2.75	3.20	0.84	2.70
48.8	12	2,885	11.7	2.90	3.30	0.72	3.05
49.3	10	3,640	11.7	3.50	3.60	0.85	2.90
50.2	3	3,050	11.5	3.00	3.60	0.80	2.78
50.4	10	2,900	11.4	3.10	3.65	1.04	2.73
51.8	10	3,230	11.6	3.10	3.50	0.77	2.95

Peyton[7] (1931) has studied the dimensions and growth of the palate in the normal infant and in the infant with gross maldevelopment of the upper lip and palate. His findings for the normal newborn are given in Table XII. Peyton made his measurements directly upon casts of the palate. The dimensions taken were as follows: (1) the widest transverse diameter, (2) the surface width of the palate, (3) the height of the palate, and (4) the chord of the alveolar process.

The widest transverse diameter of the palate was taken in approximately the coronal plane, using the middle of the alveolar process as end-points. The surface width of the palate was taken in approximately the same coronal

plane as the widest transverse diameter and with the same end-points but in the following manner. A thin sheet of lead was cut into strips from 1 mm. to 2 mm. wide, and this strip pressed firmly against the palate so that it assumed the shape of the palate surface including all its irregularities. After the strip had been pressed into position, it was cut at the end-points of the measure, that is, where the strip passed over the midportion of the alveolar process. The strip was then removed, pressed out on a flat surface to remove all irregularities, and with a calipers this straight piece of metal was measured.

The height of the palate was taken by placing a rigid metal bar across the palate at its deepest portion, and the distance from the upper surface of this metal bar to the deepest point of the mold was read. The width of the transverse bar was subtracted from this reading and the remainder taken as the actual height of the arch of the palate. A true curvelinear measurement of the length of the alveolar process was not taken, but instead a straight line measurement, the arc of the alveolar process, was measured to estimate its length. It was taken from the midpoint anteriorly to the posterior end of the alveolar process on each side. The measurement for each side was recorded separately, but the average of both sides was ultimately used.

TABLE XIII

THE DIMENSIONS OF THE NEWBORN PALATE ACCORDING TO VARIOUS INVESTIGATORS

	NUMBER	AGE IN DAYS	BREADTH MM.	LENGTH MM.	HEIGHT MM.	PALATAL INDEX	PALATAL HEIGHT INDEX
Alkan	35	4.1*	27.0	32.0	12.0	84.3	22.6*†
Franke	?	Newborn	32.0*	26.8		119.3*	
Denzer	1	12.0	30.0		11.3		37.0
	38	28-308	30.9		8.7		28.0
Katz	23	Newborn				90.4	22.5
Peyton	13	6.1*	31.8*	29.3*	8.5*	108.5*	26.2*
Ashley-Montagu	90	3.7	30.6	25.6	7.6	119.9	24.8

*Calculated from the author's data by A-M.

†Alkan gives this index as 43.1, according to the formula $\frac{\text{Height} \times 100}{\text{Breadth}}$ instead of $\frac{\text{Breadth} \times 100}{\text{Height}}$

It will be observed that the figures given by these investigators for the various dimensions of the palate (summarized in Table XIII) which, with the exception of those given by Alkan, were obtained in much the same way from points which differ not very considerably from our own, that these figures likewise differ but slightly from our own. Thus Franke finds the maximum palatal breadth to be 5.2 mm. greater than the maximum palatal length, Peyton 2.5 mm. greater, while my own figure is 5.0 mm. greater, summated giving an average excess of breadth over length of 4.2 mm., for an average breadth of 31.4 mm. and an average length of 27.2 mm. However, Peyton's palatal length chord which is a diagonal is greater by at least 3.0 mm. than the normal raphe chord, and in order to be compared with my own figures Peyton's length chord should read 26.3 mm. instead of 29.3 mm. with an excess in breadth over length of 5.5 mm. which is at once comparable with Franke's figure of 5.2 mm. and my own of 5.0 mm.; the average total palatal

length of the three authors is, therefore, 26.2 mm. Franke is within –0.6 mm. of this value, Peyton –0.1 mm. and Ashley-Montagu –0.6 mm., giving an average deviation of –0.43 mm. The average excess of breadth over length is 5.2 mm. The average palatal index is 119.8, and the average of the summated palatal height according to the available figures of Peyton and my own is 8.0 mm. The average palatal height index is, therefore, 22.2 mm., which agrees fairly closely with that found by Katz of 22.5 mm. and that of Alkan of 22.6 mm. (Table XIV.)

TABLE XIV

THE AVERAGE OF THE SUMMATED VALUES OF THE DIMENSIONS OF THE NEWBORN PALATE ACCORDING TO FRANKE, PEYTON, AND ASHLEY-MONTGAU

MAXIMUM BREADTH MM.	MAXIMUM LENGTH MM.	EXCESS OF BREADTH OVER LENGTH MM.	PALATAL INDEX	PALATAL HEIGHT INDEX
31.4	26.2	5.2	119.8	22.2*

*Represents Peyton and Ashley-Montagu with a total of 103 cases.

We may conclude from these figures, therefore, that the gingival maximum breadth of the palate, 31.4 mm., exceeds by 5.2 mm. the maximum gingival length of the palate 26.2 mm.

The averages derived from my own series give a maximum breadth of 30.6 mm. and a length of 25.6 mm., a difference in favor of the breadth of 5.0 mm. We also find that the anterior breadth of the palate, 25.5 mm., is exactly equal to the posterior breadth of the palate, 25.5 mm., and almost exactly equal to the length, 25.6 mm.

In passing it is interesting to note that there is an almost perfect correlation in the series between the averages for nasion prosthion height, 31.0 mm., and the maximum palatal breadth, 30.6 mm.

In this paper I have abjured altogether the use of such expressions as "horseshoe type," "parabolic" and "U-type" in describing the form of the palate. Such expressions are misleading for they do not provide a true conception of the form of the palate but rather describe the visual impression created by the converging posterior buccal margins of the gingivae, which, as I have already shown, does not in any way correspond to the form of the developing maxilla above. I have chosen, therefore, to express the form of the palate by means of indices, and, as we have already seen, the average palatal index we find to be 119.9, i.e., brachyuranic, expressing the fact that the newborn palate is a broad palate. This index differs from the palatomaxillary index of Flower which expresses the relation between the maximum length and the posterior palatal breadth; according to this index the value for our palates would be 95.6. It is possible that Katz who does not say how she took the palatal breadth, and whose figures give a palatal index of 90.4 used the palatomaxillary index in determining the palatal index; in that case her palatal index would resemble my own very closely.

We found that in 73 out of 83 cases, that is, in 87.9 per cent, the palate ranged in form between mesuranic in 43.4 per cent of cases and brachyuranic

in 44.5 per cent of cases, and that an excessively broad palate was found only in two instances in 2.4 per cent of cases. The long or dolichouranic palate was found in 8 cases only, that is in 9.6 per cent of cases.

As far as the anterior curvature of the gingival arch is concerned, we found that the general tendency of the curvature was toward the cycloform which was found in 33 cases or 39.7 per cent, the mesiform arch was found in 18 cases or 22.8 per cent, the propyriform in 15 cases or 18.0 per cent, the platyform in 10 cases or 10.2 per cent, and the pyriform in 6 cases or 7.2 per cent.

We found in the dolichouranic palate in a series of 8 cases that though 4 possessed a cycloform anterior arch, 1 had a propyriform and 3 a pyriform curvature; in a larger series of cases we should expect to find a larger predominance of the pyriform over the cycloform arch in the dolichouranic palate. In the mesuranic palate the most central tendency was cycloform, 13, and propyriform, 12, with 2 platyform, 6 mesiform, and 3 pyriform. The brachyuranic palate exhibits a general tendency toward the cycloform arch, 16 cases; to a slightly lesser extent we find 13 mesiform curvatures in this group; there are also 6 platyform and 2 propyriform cases. In the two examples of the hyperbrachyuranic palate, as would be expected, the anterior curvature is platyform.

We may legitimately draw the conclusion from these figures that the longer the palate is in relation to its breadth the sharper will the anterior arch tend to be, that where the palate is moderately broad in relation to its length the anterior arch will tend to be smoothly curved, and that where the palate tends to be excessively broad in relation to its length the anterior arch will be flat.

The relation between the anterior, middle and posterior palatal lengths is interesting, the value for each being respectively 6.9 mm. $\sigma \pm 2.5$ mm., 7.4 mm. $\sigma \pm 2.9$ mm. and 11.3 mm. $\sigma \pm 2.8$ mm. Thus, the anterior length is almost equal to the middle length lacking only some 0.5 mm., while the posterior length is greater by 4.4 mm. than the anterior length, and greater by 3.9 mm. than the middle length.

It will be interesting, when further work has been carried out on older age series, to observe the changes that have taken place in these relations, for by this method of measurement it will be possible to determine the nature and extent of the growth in the three sections of the long axis of the palate.

The maximum palatal height above the gingival surfaces was determined wheresoever it was found. The average height was 7.6 mm. $\sigma \pm 2.0$ mm. With respect to the situation of the palatal height point this is shown in Table XV. Ninety cases were examined; in 56 of these the palatal point was situated posteriorly, that is, posterior to the maximum breadth chord, the average posterior distance from the maximum breadth chord was 1.6 mm. In 6 cases the palatal point was situated upon the median raphe an average of 2.0 mm. posteriorly; in 21 cases the palatal point was situated an average of 0.8 mm. to the left of the median raphe, and 1.6 mm. posteriorly; in 29 cases the palatal point was situated an average of 0.4 mm. to the right of the median raphe and 1.3 mm. posteriorly.

In 34 cases the palatal point was situated an average of 0.9 mm. anterior to the maximum breadth chord. In 5 cases the palatal point was situated an average of 0.9 mm. anteriorly; in 14 cases there was a deviation to the left of an average of 0.7 mm., and an average situation of 0.8 mm. anteriorly; in 15 cases there was a deviation to the right of 0.8 mm. and an average anterior situation of 1.2 mm.

TABLE XV

SHOWING THE SITUATION AND RELATIONS OF THE MAXIMUM PALATAL HEIGHT POINT TO THE MEDIAN RAPHE AND THE MAXIMUM BREADTH CHORD

TOTAL NUMBER OF CASES	SITUATION	MEDIAN RAPHE CASES	AVERAGE DISTANCE MM.	DEVIATION TO THE LEFT CASES	AVERAGE DISTANCE MM.	AVERAGE DEVIATION TO THE LEFT MM.	DEVIATION TO THE RIGHT CASES	AVERAGE DISTANCE MM.	AVERAGE DEVIATION TO THE RIGHT MM.
56	Posterior	6	2.0	21	1.6	0.8	29	1.3	0.4
34	Anterior	5	0.9	14	0.8	0.7	15	1.2	0.8

Thus, we find that in 62.2 per cent of cases the palatal point is situated an average of 1.6 mm. posterior to the maximum breadth chord. Of this number 10.7 per cent are situated on the median raphe, 37.5 per cent to the left of the median raphe and 51.8 per cent to the right of it.

In 37.8 per cent of cases the palatal point is situated an average of 0.9 mm. anterior to the maximum breadth chord, of this number 14.7 per cent are situated on the median raphe, 41.2 per cent are situated to the left of the median raphe, and 44.1 per cent to the right of the median raphe.

Thus the maximum palatal height point occurs nearly twice as frequently posterior to the maximum breadth chord as it does anteriorly, and almost twice the distance of the distance of the anterior point from the maximum breadth chord.

These figures are interesting for this reason: the maximum palatal length is 25.6 mm.; if we halve this to find the midcoronal plane of the palate, we obtain 12.8 mm.; if we follow this measure on the median raphe, we obtain the center of the palate. Now the distance of the maximum breadth chord from the incisive point is 14.3 mm., that is to say, the maximum breadth chord is situated 1.5 mm. posterior to the midcoronal plane; if, therefore, the average distance of the palatal point posterior to the maximum breadth chord is 1.6 mm. in 56 cases, then the total posterior distance from the coronal plane or middle of the palate of the palatal point is in these cases 2.1 mm. Whereas for the 34 cases in which the palatal point was situated some 0.9 mm. anteriorly from the maximum breadth chord, the distance from the coronal plane of the palate is only 0.6 mm. posterior. The total average deviation to the right of the median raphe is 0.7 mm. and to the left 0.6 mm. Thus it may be concluded that the highest point of the palate is generally situated at approximately the exact center of the palate.

The palatal height index, that is, the relation between the maximum height and breadth of the palate, we found to be 24.8 $\sigma \pm 2.3$. Katz found this index to be 22.5, Alkan 22.6, and Peyton 26.2. The average of these authors' summated 71 cases is 23.8, a value which almost exactly equals that derived from my own series; 24.8 is a low index indicating a rather flat vault. According to Martin's *Lehrbuch* (Vol. 11, p. 933, 1928), the palatal height index for the majority of the races of mankind may vary between 21.0 and 55.0. We have calculated the average palatal height index from the figures given by Martin and obtain therefrom an index of 32.5. Similarly we have calculated the palatal height index for the adult between thirty and fifty years from the figures provided by Franke.[4] This we found to be 35.5. This latter index we may take to be representative for *Homo Caucasiensis*. If this is so, then the average palatal height for adult Caucasian man is 13.3 mm., that is, the adult palate is absolutely 5.7 mm. higher than the newborn palate according to our figures; the relative difference is brought out in the average palatal height 35.5 mm. for the adult and 24.8 mm. for the newborn. So that relatively compared to the adult palate the newborn palate is a fairly low vaulted one. The comparative flatness of the newborn palate is, however, to the largest extent due, in our opinion, to the undeveloped state of the body of the alveolar process. In this we agree with Katz[6] who writes, "Der fetale [newborn] harte gaumen erscheint dem des Erwachsenen gegenuber relativ flach. Das findet seine Erklarung darin, dass kein zahntragender Alveolarfortsatz ihre umzieht und scharfer absetzt."

Franke[4] and Brash[5] have already shown that increase in the height of the palate is due to the downward growth of the alveolar arches which takes place at a greater rate than the downward growth of the undersurface of the palate. Moreover, our own observation of palates of fetuses between the third and sixth month shows that the alveolar processes are generally so little developed that they form a plane with, and in some cases may be even higher than, the palate itself; at birth, therefore, as well as subsequently, the palatal height it seems, is conditioned to the largest extent by the state of development of the alveolar arches.

SUMMARY

The casts of the palates of 90 newborn children of an average age of 3.70 $\sigma \pm 2.8$ days were studied with respect to their form and dimensions. With one exception, a negro, the children were of Caucasian stock, with an average weight of 3315.0 $\sigma \pm 539.5$ grams, a sitting height of 332.0 $\sigma \pm 17.6$ mm., and a nasion prosthion height of 31.0 $\sigma \pm 1.4$ mm.

A palate not belonging to this series was studied on the fresh specimen in order to determine (1) the nature of the various sulci which appear upon the gingival surface, and (2) the relation of the soft palatal structures, borders, margins, and points to the underlying bony structures. In consequence it was found that the anterior, anterolateral, and lateral sulci corresponded to the separating walls of the crypts of the developing teeth. The thickness of the gingivum anteriorly was found to be deepest, 6.5 mm., at the lateral

sulcus point 5.5 mm., the molon point 5.6 mm.; from the latter point onward there being a rapid decline to 0.2 mm. at the postgingival point. The posterolateral margins of the fresh palate present a convergent appearance; there is no underlying skeletal structure to which this convergence corresponds.

A membranous division, the *pars posterioris* which completes the alveolar maxilla posteriorly, and which has been found to consist microscopically of dense, white, fibrous connective tissue is described. This forms the true posterior boundary of the newborn maxillary or alveolar process. The maximum palatal breadth is 30.6 $\sigma \pm 1.5$ mm.; the posterior palatal breadth 25.5 $\sigma \pm 1.2$ mm.; the maximum palatal length 25.6 $\sigma \pm 1.6$ mm.; the anterior palatal breadth 25.5 $\sigma \pm 1.5$ mm. The average anterior breadth was found to be equal to the average posterior breadth, and these two dimensions are almost exactly equal to the maximum length. The maximum breadth is situated an average of 1.5 mm. posterior to the midcoronal plane of the palate and exceeds the anterior and posterior breadths by 5.1 mm.

The frequency of the types of palate were as follows: dolichouranic 8, mesuranic 36, brachyuranic 37, hyperbrachyuranic 2. The average palatal index is 119.9 $\sigma \pm 6.7$, the type palate is, therefore, brachyuranic.

The palatal height is 7.6 $\sigma \pm 2.0$ mm. and was generally found at about the exact center of the palate. Owing to the undeveloped condition of the alveolar arches the palate appears to be relatively flat when compared to the adult. The anterior palatal length is 6.9 $\sigma \pm 2.5$ mm., the middle palatal length 7.4 $\sigma \pm 2.9$ mm., and the posterior palatal length 11.3 $\sigma \pm 2.8$ mm.

It is shown that the so-called typical human palate is in the newborn actually of anthropoid type.

[Completed July 16, 1932.]

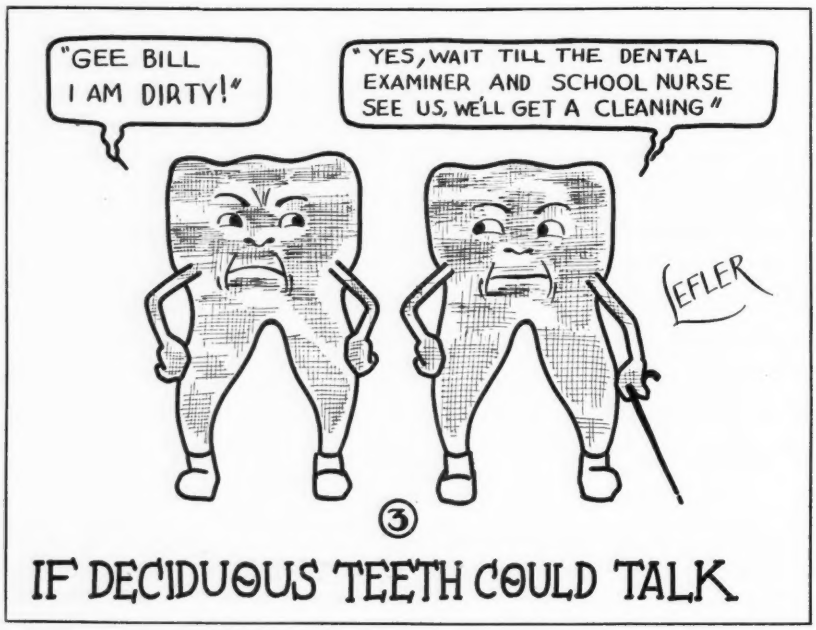
REFERENCES

8. West, C. M.: The Development of the Gums and Their Relationship to the Deciduous Teeth in the Human Fetus. Contrib. to Embry., No. 79, Washington, pp. 25-45.
9. Clinch, L.: Variations in the Mutual Relationships of the Upper and Lower Gum Pads in the Newborn Child (With a Statistical Analysis of the Data by M. Young), Dental Record 53: 153, 1933. INTERNAT. J. ORTH. 20: 359, 1934. This paper was published too late for notice in the present study. The results obtained by the authors, however, are much the same as my own.

IF DECIDUOUS TEETH COULD TALK

HARRY B. SHAFER, D.D.S., ANNA, ILL.

IF DECIDUOUS teeth could talk and make a frank statement to the public decrying the fact that stains are allowed to accumulate on their surfaces, dentists would be forced to do something about it or to refer the patients to other dentists who would care for them.


"GEE BILL I AM DIRTY!"
"YES, WAIT TILL THE DENTAL EXAMINER AND SCHOOL NURSE SEE US, WE'LL GET A CLEANING"
LEFLER
③
IF DECIDUOUS TEETH COULD TALK

Every time we see a well-dressed, healthy child with stained teeth, we should suspect that our profession has failed in its educational work. Leaving this important duty to the school nurse and dental examiner is quite usual; but, after all, assuming responsibility ourselves brings a certain amount of satisfaction and results. The old excuse that people will think we are commercializing our profession is a weak one and will not hold water. It is high time that we earnestly advised periodical prophylaxis.

OUTLINE OF PEDODONTIA COURSE AS TAUGHT AT MARQUETTE UNIVERSITY

GEORGE E. MORGAN, D.D.S., F.A.C.D., MILWAUKEE, WIS.

Junior Course—First Semester.

I. Definition of pedodontia and its purpose.

II. Child psychology:
  1. Definition as it is applied to dentistry for children.
  2. Classification of the various types of children.
  3. Physical equipment necessary for the management of children.

III. Management of the child in the clinic:
  1. Rules for the management of children.
  2. Attitude of student toward the child,
    A. Method of approaching and receiving the child.
  3. Handling and controlling children who have a fear of dentistry,
    A. Correct hours for appointments.
    B. Environmental influences which have a direct bearing upon child management.
    C. Control of the child's hands.

IV. Anatomy of the deciduous teeth:
  1. Marked characteristics.

V. Examination:
  1. Methods of making mouth examinations,
    A. Explorers and their relation to the detection of caries in the various areas of the mouth.
      1. Areas of susceptibility.
      2. Areas of immunity.
    B. Roentgenographic.
    C. Soft tissues.
    D. Occlusion.
    E. Habits—early detection of habits as a preventive measure.

VI. Diagnosis:
  1. General consideration of the child—health of child must be paramount.
  2. Roentgenographic.

VII. Oral prophylaxis:
  1. Importance.
  2. Technic.
  3. Home care,
    A. Correct way for child to brush teeth, including type and size of brush.
    B. Correct time and reasons for child to brush his teeth.
    C. Diet as affecting prophylaxis.
  4. Stains and deposits found in children.

VIII. Eruption and exfoliation:
1. Time and order of deciduous eruption.
2. Time and order of deciduous exfoliation.
3. Time and order of permanent eruption.

IX. Calcification:
1. Time of beginning of calcification of deciduous teeth.
2. Diet and its relation to calcification,
   A. Prenatal.
   B. Postnatal.
3. Time of beginning of calcification of permanent teeth.

X. Reasons for filling children's teeth.

XI. Cavity preparation:
1. Marked differences in shape and structure of deciduous and permanent teeth which must be taken into consideration in cavity preparation.
2. Age of child and tooth development.
3. Position of tooth in mouth.
4. Method of procedure,
   A. Instruments, burrs and their usage.
   B. Rules for cavity preparation.

XII. Filling materials and their application:
1. Filling materials available for children's teeth.
2. Advantages and disadvantages of various materials.
3. Preparation and application of various materials.

XIII. First permanent molar:
1. Importance of early attention.
2. Conditions that affect normal development.
3. Periods of care.
4. Prophylactic odontotomy.
5. Permanent restorations.

XIV. Taking of impressions and making of study models.

Junior Course—Second Semester

Group Instructions:

The principles of pedodontia covered in the first semester are applied to a child clinic patient. Individual problems of the students in handling children are discussed.

The student is not allowed to work on children in the dental clinic until the second semester of his junior year. This enables him to get operative practice on adults before attempting dentistry for children. The junior student is required to complete twenty-five unit hours in pedodontia. The same credit as for adults is given for service to children in all phases of clinical practice.

Senior Course

I. Embryonic growth and development of the teeth and jaws.

II. Preventive measures:
1. Etiology of dental decay.
2. Diet.

3. Promotion of normal function.
4. Prophylaxis.
5. Preschool dentistry.

III. Deciduous anatomy:
1. Dissection of deciduous molars for anatomical study.

IV. Roentgenographic interpretation of the teeth and jaws of children.

V. Operative measures:
1. Growth and development and its relation to operative procedures in dentistry for children,
   A. Extent of caries.
2. Posterior restorations.
3. Anterior restorations,
   A. Approximal surfaces.
   B. Fractures.
4. Pits and fissures.

VI. Filling materials:
1. Permanency of materials to be considered when placing restorations.
2. Extent of cavity to be considered when placing restoration.

VII. Resorption of the roots of deciduous teeth:
1. Normal.
2. Abnormal.

VIII. Extraction:
1. Rules for extraction.
2. Kinds of anesthesia used for children.
3. Treatment of abscessed teeth.

IX. Prosthetic dentistry for children:
1. Accidental loss of deciduous teeth.
2. Accidental loss of permanent teeth.

X. Habits and their treatment:
1. Early detection.
2. Prevention and correction.

XI. Anomalies of the deciduous and permanent teeth:
1. Congenital absence.
2. Supernumerary.
3. Frenum labium.
4. Hypoplastic defects.

XII. Pathological conditions of the mouths of children:
1. Deficiency diseases.
2. Communicable diseases.
3. Local bacterial invasion.
4. Syphilis.

XIII. Prevention of malocclusion:
1. Premature loss.
2. Restoration of mouth to normal function.
3. Occlusion of the deciduous teeth.

4. Occlusion of a mixed denture.
5. Occlusion of the permanent teeth.
6. The value of early treatment.
7. Maintaining appliances.

XIV. Economics:

1. Office management for a pedodontic practice.
2. Equipping an office for children.

XV. Public health work:

1. History of the movement.
2. Programs of different communities.

The senior students are required to read and report on current literature pertaining to pedodontia. The senior student is required to complete seventy unit hours in operative dentistry for children.

Department of Orthodontic Abstracts and Reviews

Edited by

DRS. EGON NEUSTADT AND JOSEPH D. EBY, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. Egon Neustadt, 133 East Fifty-Eighth Street, New York City.

A Textbook of Dentistry. Review of "Klinische Zahnheilkunde" by Alfred Kantorowicz. Third edition, 2 volumes, 1,510 pages, 1,690 illustrations. Berlin, Hermann Meusser.

This publication is probably one of the most complete treatises on dentistry which ever was written by one author.

The chapter on orthodontia is a little textbook in itself. It consists of 70 pages. The most radical feature of it is the nearly complete departure from the Angle classification. A diagnosis is demanded which goes beyond descriptive classification into the realms of orthodontic etiology.

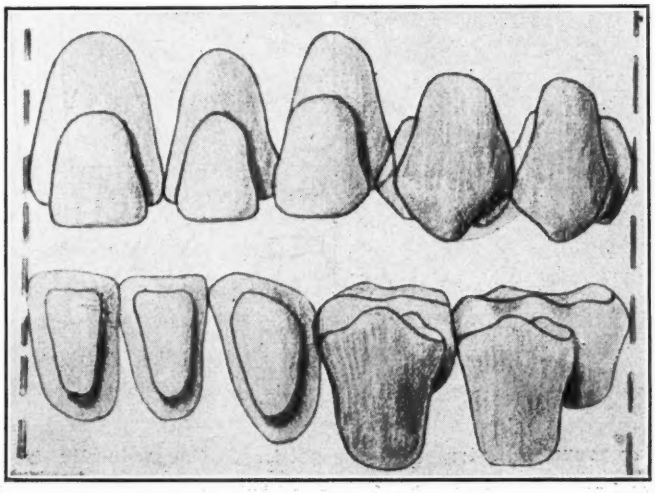


Fig. 1.—Comparative sizes of deciduous and permanent teeth. In the incisor region, the permanent teeth are wider; therefore, spaces occur between the deciduous teeth. In the premolar region, the permanent teeth are smaller, therefore, spaces occur between the permanent teeth.

ETIOLOGY OF DISTOCLUSION

As an example of the etiologic viewpoint, the transition from deciduous to permanent dentition is described in great detail. In the region of the incisors, the growth in width of the jaws takes place through intrinsic forces, and not through the mechanical pressure of the larger permanent teeth. The increase in size from the maxillary deciduous to the maxillary permanent incisors is greater than the increase in size for the corresponding mandibular teeth. For

this reason, a slight forward moving of the mandibular teeth occurs, which, as we shall see later on, is of importance for the correct interlocking of the first permanent molars. (Fig. 1.)

In the region of the deciduous molars, spaces occur when the premolars erupt because of their smaller mesiodistal diameters. The permanent canine takes advantage of part of these spaces because, being larger than the deciduous canine, the loss of the latter would not give it sufficient room.

Besides these changes in the width and length of the jaws, it is essential that the mandibular teeth move slightly forward when the permanent first molars

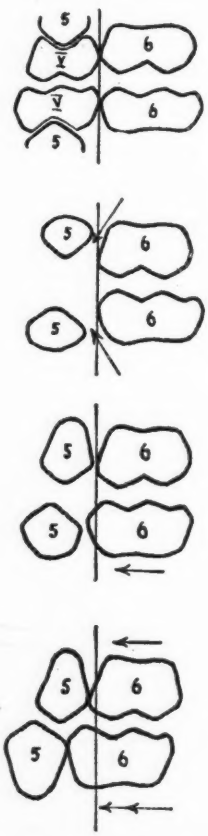


Fig. 2.—Molar eruption under normal conditions. The reduction in size between the mandibular deciduous second molar and its successor is greater than the reduction in size between the corresponding maxillary teeth. The mandibular first permanent molar moves, therefore, further mesially which fact insures its normal mesiodistal relationship.

erupt. For the maxillary deciduous molars are smaller than the mandibular deciduous molars and, therefore, do not extend distally beyond them. If the permanent molars came in without the mandibular teeth moving forward, they would occlude in a cusp-to-cusp relation. This condition actually occurs quite often. It can later on correct itself when the smaller mandibular premolars supplant their deciduous predecessors, and thereby allow the permanent first molar to move forward. Otherwise, there is a danger of the mandibular molars sliding into a distal position. (Fig. 2.)

A distal relationship of the mandibular molars may, therefore, be caused by:

1. Lack of forward moving of the mandibular teeth at the time of incisor eruption (insufficient space).

2. Lack of forward moving of the mandibular teeth due to a tight interlocking of the deciduous molars (insufficient wear).

3. Delayed shedding of the mandibular second deciduous molar or premature loss of the maxillary second deciduous molar. (Fig. 3.)

4. A mandibular deciduous molar which is too large in comparison to its opponent.

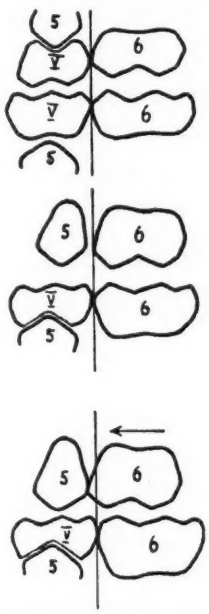


Fig. 3.—Development of a distoclusion due to the prolonged retention of the mandibular second molar.

Much as the etiologic viewpoint appeals from the scientific standpoint, it shows very strikingly our unfortunate shortcomings in the knowledge of etiology. Many assumptions must be made for lack of sufficient study and proof. This is the great disadvantage, at least at the present time, of this orthodontic system based on etiology. The latter is, however, carried out in great logic and consequence. In the beginning, the reader is rather surprised to find all orthodox methods of classification abandoned and substituted by classifications of an entirely different character.

The malocclusions are described under the following divisions:

A. *Mesial position of mandibular teeth or jaws,* mostly due to heredity.

B. *Closed bite,* mostly due to heredity.

C. *Diastema,* mostly due to heredity.

D. *Distoclusion:*

1. Due to lack of normal development of the mandible.
2. Due to faulty eruption of the first permanent molars when the maxillary second deciduous molar is too small or the mandibular second deciduous molar is too large.

3. Due to faulty eruption of the first permanent molars caused by local conditions (caries of maxillary deciduous molars).

E. *Malocclusions due to compression of the jaws:*

1. Compression with crowded and protruded maxillary incisors.
2. Compression with spaced and protruded maxillary incisors (thumb-sucking).
3. Compression with crowded incisors.

F. *Shortening of the jaws* due to premature extractions.

G. *Deformations* through abnormal occlusal pressure (open-bite).

H. *Malocclusions* caused by:

1. Arrest of development (cleft palate).
2. Supernumerary teeth or congenitally missing teeth.
3. Displacements of tooth germs.
4. External causes of malocclusions (operations, scars, tumors, etc.).

The defects of such a division become evident when one sees that the closed bite is listed as a distinct and separate malocclusion. The closed bite, or excessive overbite, is only a symptom accompanying different malpositions, namely those which are characterized by a malposition of either the maxillary incisors labially or the mandibular incisors lingually. Then the incisors have no occlusal contact with their opponents and are prone to erupt further than normal. This happens in protrusions of the maxillary incisors, in distoclusions, etc., and should be discussed under those headings.

While dealing with the factors influencing tooth eruption, Dr. Kantorowicz stresses the fact that malnutrition delays tooth eruption. Dwarfs, for instance, retain their deciduous set up to twenty years. And among the German children who were reared during the World War when the blockade was in force, only a very small percentage had their first molars when they entered school at six years. In their general development and size, they were one year backward as compared to children born in times of peace.

Prolonged retention of the permanent teeth is ascribed to the following conditions:

1. The distance between the tooth and its place of eruption is too great.
2. The direction of the tooth eruption is incorrect.
3. The tooth is malformed or its root is curved.
4. Supernumerary teeth are present.
5. Injury to the tooth germ has occurred at the time of its formation.
6. Systemic disease is present (rickets, syphilis).
7. Inflammation of the tooth-sac took place.
8. The tooth-sac is degenerated cystically.
9. The tooth-germ is displaced by a tumor.
10. Heredity.
11. The tooth has united with the jaw bone.

MECHANICS OF MASTICATION

In the chapter on physiology, we find interesting data regarding the mechanics of mastication and mouth digestion.

After the incisors have bitten off a piece of food, the tongue carries it between the molars and there it is crushed. Then another portion of the bite is carried between the molars, and the crushed food is moved into the space between teeth and cheek. This process is repeated until the whole piece which was bitten off is crushed and lodged in the cheek pouch. Then the play starts all over again. On a piece of apple we chew about 25 times, on a piece of bread, 40 times. A force of from 40 to 80 pounds is used.

MOUTH DIGESTION

During the time of this mechanical trituration, the food is open to the action of the saliva. The chemical reaction of the saliva is slightly alkaline at the time of its secretion; but it soon turns acid under the influence of fermenting food particles in the mouth. Even an acid saliva is, however, unable to produce a decalcification of the enamel.

During a period of twenty-four hours, the secretion of saliva amounts to about 3 pints. The saliva consists of approximately 99 per cent water and of 1 per cent albumin, mucin, salts, and the enzyme ptyalin. It also contains bacteria, dead epithelial cells, and leucocytes.

The mucin gives the saliva its viscous quality. Its amount is subject to great variations. In chronic inflammations of the gingivae, it is strongly increased.

Among the salts, the most important ones are the carbonates and the salts of the phosphoric acid. They are kept in solution through the presence of carbonic acid. After evaporation of the carbonic acid, they form a sediment which is known as salivary calculus.

Mention may also be made of the sulphocyanide. This substance is supposed to combat caries. However, some caries-immune animals have no sulphocyanide in their saliva while persons with a definite sulphocyanide reaction show sometimes abundant caries.

The active part of mouth digestion is carried on by the ptyalin. It converts unsoluble starches into soluble dextrin and maltose. Under normal conditions, mouth digestion does not go any further.

Besides the ptyalin, there is a catalytic enzyme in the saliva which liberates oxygen from peroxide; and a proteolytic enzyme, which is confined to the leucocytes of the saliva. The proteolytic enzyme dissolves gelatine, serum, and also decalcified dentin.

The secretion of the saliva is due to nerve stimulation of a peripheral character (taste, smell, chewing) as well as of a central character (thoughts, imagination).

As far as the relationship between saliva and caries is concerned, it is found that the saliva tends, on the one hand, to combat caries. This it does by neutralizing, with its weak alkalinity, the caries process which is always acid; by diluting the injurious acids; and by mechanically rinsing the teeth (note the

immunity of the mandibular incisors as compared to the nonimmunity of the maxillary incisors!). On the other hand, the caries process takes place within the saliva and is really dependent on it because its water content is essential for the life of the bacteria.

This abbreviated exposition of mechanical and chemical actions during mastication, is a sample from the chapter on physiology, where we also find a very compact but complete survey of dental anatomy and histology. The formation of the sounds of the human speech is explained in detail. (But the influence which malpositions of teeth play in the disturbance of correct sound formation is not mentioned. This is a problem which confronts orthodontists occasionally and which should be given more thought and study in the future than it has in the past.)

Other chapters deal with mouth pathology, oral surgery, dental pathology, therapy, and prosthetic dentistry.

A separate portion is devoted to topics on the borderline between dentistry and medicine, such as endocrine disturbances, vitamin deficiencies, laryngology, gynecology, and occupational diseases.

The thoroughness with which each topic is treated makes the work one of the most complete textbooks on dentistry. Instructive illustrations are used throughout. Print, binding and physical set-up conform to the fine reputation of the publisher.

E. N.

International Journal of Orthodontia and Dentistry for Children

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 3523-25 Pine Blvd., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 75 cents. To any place in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $7.00 per year in advance. Under foreign postage, $7.40. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, post office or express money order, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this Journal.

Opinions—Neither the editor nor the publisher holds himself responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—The publishers will communicate with authors regarding reprints upon publication of paper.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Dr. H. C. Pollock, 4482 Washington Blvd., St. Louis, Mo. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 3523-25 Pine Blvd., St. Louis, Mo.

Illustrations—Such half-tones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements — Objectionable advertisements will not be accepted for publication in this Journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply may be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIAL

More Service and More Work

IN AN examination of more than 1,000 public school children the board of education reports that 78 per cent have inferior posture, 54 per cent have curvature of the spine, and 3 per cent have flat feet. In an orthodontic survey of some 300,000 school children an estimate has been made that approximately 51 per cent have malocclusion. The estimated decay of teeth in some school children has been found to be in excess of 90 per cent. If all these surveys are correlated, it is quickly seen that physical examination of school children reveals defects far in excess of what has been previously supposed. The above mentioned reports included only posture, curvature of the spine, flat

feet, malocclusion, and dental caries. These defects, of course, only scratch the surface of the important physical defects to which children may be heir.

The problem is obvious. For the thousands of school children who need scientific treatment for physical ills, there are thousands of men able to provide these services who are idle much of their producing time. The problem, then, is both social and economic, and any formula for the solution must provide service for the children and at the same time provide a living for those who serve.

The solution of the problem, however, is not so simple. Kettering, of General Motors research fame, who has had great experience with problems and their solution, says first of all pick out what you are trying to do—get an objective—then it sometimes is well to shake it up a little to see whether or not you want that objective. (Perhaps everything is better off as it is.) He says also that you have to know where you are going before you start an experiment, or when you get there you won't know whether that is where you want to be.

In applying Kettering's philosophy here, there is no difficulty in stating just what the problem is; however, when we read the many solutions which are offered and start to "shake them up," we soon are confronted with the shocking realization that as a profession we do not know where we are going, hence, when we get there, we cannot know whether or not that is where we want to be.

The ever increasing activities for socialized medicine must be watched coolly and with apprehension, for when it arrives it may find out it is not where it wants to be. If dentisry, bovinelike, follows medicine blindly through this crisis without a careful analysis of her own needs, in all probability she will find that her economic situation is one apart from that of medicine. It is one thing to set a broken leg or treat a case of typhoid fever, and it is another thing to supply a bridge of five teeth or treat an abscessed tooth or a case of malocclusion. The former lends itself to a public that is insurance minded; the latter does not do so—it carries with it an association of a "private school" standard of living for luxury-minded people.

H. C. P.

During the meeting of the Great Lakes Association of Orthodontists held in Toronto in May, 1934, a short report of a study on the relationship of *L. acidophilus* to dental caries was presented.

The study showed no close correlation between the development of new cavities and the presence or absence of *L. acidophilus*. In this report no cognizance was taken of the degree of progression of established cavities. In view of a lack of uniformity in the classification of the degree of progression of cavities by different groups of investigators, the present study is being extended. Therefore, for the present we do not desire to make a final statement.

June 21, 1934.

Marion M. Johnston,
Department of Paediatrics,
University of Toronto.